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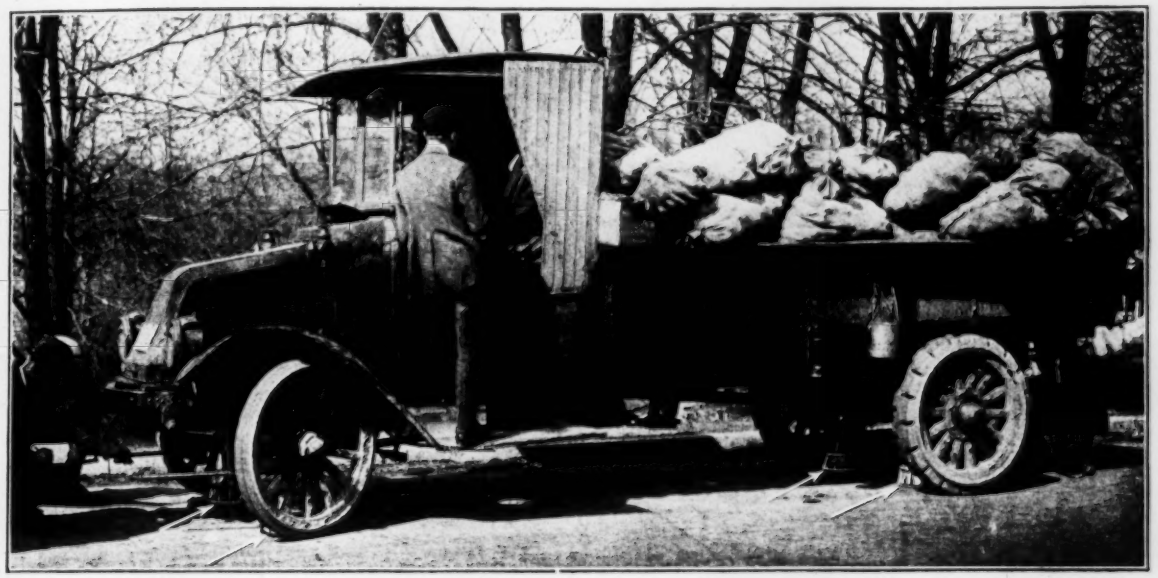
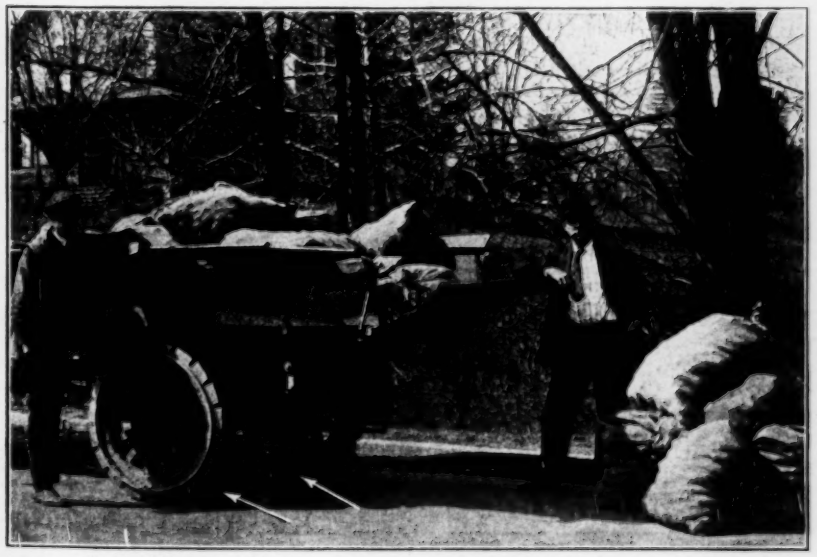


## How Maryland Enforces Its Motor Vehicle Law

When the imposition of fines on violators of the 20,000-lb. gross weight limit proved ineffective, the policy was adopted of weighing suspected trucks and compelling drivers to discharge the excess load *at the roadside*, as shown in the pictures on this page. An article in this issue gives further details.



### *In This Issue:*

Coaling Station for City Engine Terminal: P. & R. R. R.

Some of the Engineering Aspects of Public Health

Flat-Slab Floors Built Without Drops or Capitals

Repair of Arizona Concrete Arch Bridge Damaged by Settlement and Floor Expansion

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# ENGINEERING NEWS-RECORD

DEVOTED TO CIVIL ENGINEERING AND CONTRACTING

E. J. MEHREN, *Editor*

Volume 86 — NEW YORK, APRIL 21, 1921 — Number 16

## Hoover and Engineering Council

MR. HOOVER'S resignation as president of the American Engineering Council will naturally be much regretted. During his service of less than a year he has been an important factor in giving vigor to the council's work, and he has been responsible for inaugurating the industrial wastes survey which promises to be of great value to the country. It would have been helpful had he been able to serve out his term. Nevertheless, it is apparent that he as a member of the Cabinet might be placed in an embarrassing position because of the activity of the council in public affairs. The engineering profession is much indebted to him for his work in successfully inaugurating the council's work.

## The Broader View

THE recent death of Ernst J. Lederle, twice commissioner of health of New York City, again calls attention to the fact that to be a successful health officer neither medical education nor experience is necessary. Dr. Lederle was a chemist. John A. Vogelson, for many years chief of the bureau of health of Philadelphia, is an engineer, and so is Henry F. Vaughan, commissioner of health of Detroit, and so also are and have been a long line of health officers in Montclair and other New Jersey towns. Despite all this the New York statutes require health officers in that state, outside New York City, to be physicians. Some day, this bar against men with more real training in matters affecting public health, sanitary engineering, chemistry, bacteriology, sociology, and vital statistics may be removed. Meanwhile the cities of many other states are permitted to draw on all classes of men competent to serve as health officers. The results attest the wisdom of the greater latitude thus afforded.

## Foundation and Superstructure

AN EARLY warning of trouble is recalled by the Tempe failure. Just after the bridge was built V. H. Cochrane pointed out in *Engineering News* of June 12, 1913, p. 897, that the piers were inadequate, lacking stability even under unbalanced live load, not to speak of what might happen if one arch were altogether removed. Since the arches are three-hinged, this lack of stability means that the bridge stood up largely because of the continuity of minor structural elements (as the roadway), supplemented by the chance lateral resistance of the earth around the pier cylinders and piers. Undoubtedly the highly eccentric pier thrusts arising from moving loads would tend to rock the piers back and forth, and the weakness would be more likely to show its effect when the supporting soil was removed by scour. While the facts are not sufficient to demonstrate that this action played a determining part in the failure, yet the case as a whole is a most suggestive reminder of the ever present interdependence of superstructure and foundation.

## President Harding on Highways

MORE space was given to highways by President Harding in his first message to Congress than was ever before devoted to the subject in a Presidential address. His statements are sound wherever his meaning is not open to debate. It is difficult to know, however, just what the President's position is on a federal-aid versus a "national" system of highways. We take it that he is satisfied to allow the present federal-aid method of appropriation to stand. Yet there is enough indefiniteness about his words to wonder whether he has leanings in the other direction. Again, what does he mean by saying that "the laws governing federal aid should be amended and strengthened"? What does he mean when he says that "the federal agency of administration should be elevated to the importance and vested with authority comparable to the work before it"? The automobile interests have discussed with him the creation of a federal highway commission. Was that in his mind or has he some scheme of putting in more prominent place the present Bureau of Public Roads? Under the circumstances, all that one can say is that it is worth while to have the President display such interest in the highway situation. Later we hope that his views will become more definite, or, at least, be more definitely expressed. Possibly he was seeking to leave the subject so wide open as to fit in with any policy he might formulate.

## A Presidential Lapse

THERE was in the Presidential message one lapse which we deeply regret. He said nothing about the proposed Department of Public Works. On the other hand, he devoted, relatively, a great deal of space to the proposed Department of Public Welfare. If this is evidence of the relative importance in the Presidential mind of the proposed departments the outlook for executive pressure for a Department of Public Works is distinctly discouraging. It behooves the proponents of the department to align their forces.

## Rating Cities by Water Supplies

A SANITARY rating of the cities of Indiana according to water supplies, as noted on p. 686, shows that even the cities in the highest class have an average typhoid rate of 16.1 per 100,000, a high figure compared with that of nearly all the larger cities of the country. Even the four cities in the highest class that have purification plants operated under the best conditions have typhoid rates of 12.6. Source, purity, treatment and

personnel were the factors by which the plants were classified. The tabulated typhoid rates indicate that there are other factors than water supplies which enter into typhoid causation, but that there is much room for improving the water supplies of Indiana. In this the State Board of Health should lead. The rating tables, after being put into graphic form, showing the favorable or unfavorable position of each town, might well be circulated widely in every municipality in the state, with pointed comment on the lessons they bear for each community.

### Co-ordinating Government and Business

AN INTERESTING suggestion is contained in the final report of the War Industries Board which came from the press last month. It proposes that the government continue to get the benefit that accrued during the war from associations of industries, functioning generally through their war service committees. With the aid of these associations, many of them organized at official request, the government was able quickly to mobilize the industries, to get them to introduce measures of economy, to facilitate the working of priorities, to arrange for the curtailment of production, etc. The report makes the point that no less beneficial results can accrue in peace times than during the war. It recognizes also that these agencies may work to the public's disadvantage. They can subtly influence production so as to keep it short of current demand, and thus keep prices high; they may encourage an understanding on prices, and encourage other practices that are against public welfare. To reap the benefits that can accrue to the public from such associations and, on the other hand, to prevent them from being misused, the report urges the development of some plan of relationship between them and the government. At the present the contract is purely a negative one, through the inquisitorial functions of the Federal Trade Commission. The new relation should be a constructive one, "whose duty it should be to encourage, under strict government supervision, such co-operation and co-ordination in industry as should tend to increase production, eliminate waste, conserve natural resources, improve the quality of products, promote efficiency in operation and thus reduce cost to the ultimate consumer." Such a relationship is devoutly to be wished and it would seem to be the function of the U. S. Chamber of Commerce to take the initiative in working out this desirable liaison. The co-operating agency on the part of the government might be the Department of Commerce or the Federal Trade Commission, preferably the former, since at present it is under the leadership of a man who so clearly senses the essential relationship between business and public welfare.

### Preparedness

THREE other recommendations are made in the report just referred to which have a bearing not upon the country's welfare in peace, but upon preparedness for war. As a result of the experience of the War Industries Board, the report recommends: (1) That there should be established a peace-time skeleton organization following the lines of the War Industries Board, which could be rapidly expanded in case of military emergency. It would have a chairman and various bureaus corresponding to those built up in the board. (2) That the government should devise a system for protecting and stimulating the domestic production of those things that had to be imported under much stress during the last conflict, particularly nitrogen, manganese, chrome, tungsten, dye stuffs, and coal-tar derivatives. (3) That under the supervision of the proper department of the government, certain war industries should be encouraged to maintain skeleton organizations through which they could develop the rapid manufacture of guns, munitions, airplanes, and other direct military equipment. This might be done, it is suggested, in some cases through government purchases of factories, in others through the placing of sufficient orders to permit the owner to keep the plant in existence. The obvious soundness of these proposals requires no emphasis. Unfortunately, their need does not seem to be appreciated, or, if it is appreciated, the actual procedure in the proper directions is, for some reason, delayed.

### The British Strike

GREAT BRITAIN, fortunately, has been spared the disruption and danger of the Triple Alliance strike. The railway and transport workers believed that the miners should enter a further conference proposed by the government last Friday, and when the miners refused to enter such conference unless the national pool should be one of the subjects of discussion the railway and transport leaders withdrew their support and refused to call out their men. Congratulatory remarks in the circumstances are entirely unnecessary. Everybody is interested, however, in making surmises as to the probable effect of the breakdown of the Triple Alliance upon future labor developments. Some see in it a disruption of the solidarity of British labor. Others merely emphasize the triumph of traditional British common sense. At this distance it would seem certain that the circumstances attending the break must impress even the hardened trades unionist that the infallibility of trades-union leadership is to be seriously questioned. In the minds of leaders of two of the strongest labor bodies a third organization has shown so serious a disregard of public interest that pledged support has had to be suddenly withdrawn. It is true that they themselves had perpetrated a vicious indefensible sympathetic strike but they refused to take the final step when some hope of an honorable compromise appeared. If memories were not habitually short we should think that the unreasonableness shown by the miners would seriously deter sympathetic strikes of wide scope in the future. England has been saved by the narrowest margin from a catastrophe which promised to be such a mark in British history that the Friday on which it was to begin had been dubbed, in prospect, "Black Friday." Standing alone and put in a bad position by the failure of their allies to follow them in their unreasonableness, the miners' strike should quickly collapse.

### Railway Labor Agreements

HARDLY of less importance to us than was the collapse to Britain of the proposed Triple Alliance strike is the decision of the Railway Labor Board that the national railway labor agreements in this country should be abolished July 1. We were not threatened by a serious stoppage of industry or transportation. There

was no immediate emergency upon us. Nevertheless, the continuance of the national agreements would cast a blight upon our industry of extreme seriousness. As we have pointed out before, the payment nationally of wages determined by living conditions in the high-cost centers was disrupting to the wage situation in every community. Orderly deflation could not be expected as long as the railway workers were a preferred class. Assuming that the members of the Railway Labor Board were honest and intelligent men, no other decision than that rendered could have been expected. Some of the working agreements are so absurd that they cannot possibly be defended. It is a repetition of the old story that those who overstep the bounds flagrantly are quickly brought to account.

The reversion of negotiations to bargaining between each railroad and its employees, moreover, is a counterpart of what seems to be coming in England. There the mine owners seek settlements based upon local conditions in each district. The mine workers, on the other hand, want a national agreement and a pooling of coal profits so that wages can be equalized nationally. On the broad outlines, therefore, the contests in the two cases—local control versus national—are on the same lines. It is significant that decisive actions in the two cases came in the same week and that the actions both tend in the same direction—toward a sound, economic rather than an unsound, uneconomic solution.

## "Final" Valuations

VALUATION reports on the properties of four railroad companies, including single sums given as "final" value, have been issued by the Interstate Commerce Commission, as outlined elsewhere in this issue. The reports also include a statement of sums determined by the commission as the additional cost of acquiring carrier lands due to condemnation proceedings, severance damages, etc., over and above values of adjacent lands, which the commission has been required to determine and report by the Supreme Court decision in the Kansas City Southern case. These items are reported separately and with an explanation of the method used to develop them, but no statement is made of the method employed in arriving at the single sums given as final value. The amounts are simply presented with the statement that the various factors "which appear to have a bearing on the values reported" have been taken into consideration, including the additional cost of acquiring lands, appreciation, depreciation, going concern value, working capital, and materials and supplies. For the Kansas City Southern the "final" single sum given as the value of properties owned is some 29 per cent in excess of the sum previously given in the original tentative valuation as cost of reproduction less depreciation. The railroad company has claimed a value considerably greater than that now reported and there appears no doubt that the present "supplemental" report will be strenuously protested. Here the Interstate Commerce Commission will probably be called upon to set forth the method pursued in arriving at "final" value, since the valuation act itself prescribes that methods employed shall be shown. The case is a very important one since precedents set are likely to affect the whole procedure in the federal valuation. So far the issue is very much clouded by the absence of a more detailed statement by the commission of component elements of value and the method pursued. Valuation engineers everywhere will necessarily take a keen interest in the further development of the case since principles finally prevailing will have a governing influence on methods of valuation.

## Vehicle Law Enforcement

THIS year has witnessed unusual activity in the matter of state legislation relating to the use of public highways by motor vehicles. With 9,211,295 passenger automobiles and motor trucks registered during 1920, an increase of 1,645,849 vehicles, or 22 per cent, over the 1919 registration figures, the need for insisting upon a reasonable use of state highways is apparent. The mere passage of regulatory measures, however, is no guarantee of their enforcement. State highway departments have begun to appreciate this fact and, while there is still much laxness, an unmistakable trend has developed toward the enforcement of measures which have been placed on the statute books. A case in point is Maryland, which has progressed much further than most of the other states in the matter of vehicle-law enforcement.

The details of the Maryland policy are discussed elsewhere in this issue, but it is worth while to emphasize one or two points. Most vehicle laws specify some maximum load limit for trucks and it follows that violators of this regulation can be punished only if definite evidence is produced to show that a suspected truck is actually exceeding the legal maximum. This can not be done by guesswork; it means, of course, provisions for actually weighing motor vehicles on the roads, as is done in Maryland by permanently located road scales and by mobile inspection crews equipped with weighing jacks or loadometers. Vehicle weighing on the road is a comparatively new field of highway department activity, but the practice promises soon to become widespread. Other states, such as New Jersey and Connecticut, to mention only two, are now weighing vehicles on the roads.

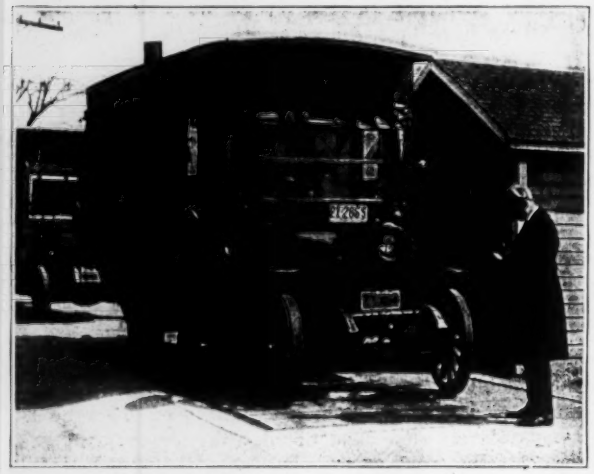
Maryland's experience has demonstrated that the mere imposition of a fine on the driver or owner of an overloaded truck is not an effective deterrent to violators of the law. The remedy has been found in compelling the discharge of the excess weight at the roadside. Where fines only were imposed it was often found profitable to load trucks beyond the capacity specified by law and to pay nominal fines, provided truck movements were not interrupted. Under the policy of removing a portion of the load, however, a great deal of inconvenience and expense is caused to the motor-truck operator. He must send out another vehicle to pick up the load deposited at the roadside, thus incurring delays and increased cost. The method of enforcement is a drastic one, but it is only by this kind of firmness that observance of the law can be secured.

As a matter of fact, right-thinking motor-truck operators are not objecting to policies which will conserve the highways for their use. Motor transport will live only so long as the highways are in a condition to carry traffic. In the end, the interests of the highway departments and of the motor-vehicle operators are one. Motor-vehicle legislation, therefore, should aim not to rule trucks off the road, but rather to strike at those selfish interests which, with a comparatively few trucks of excessive weight, soon render highways useless for other and more conservative operators and the community at large.

# How Maryland Enforces Its Motor Vehicle Law

## Truck Weights Checked by Scales and Loadometers—Ten Tons the Limit—Excess Loads Deposited at Roadsides

MARYLAND has gone a step beyond the *passage* of a motor vehicle law—*she is actually enforcing it.* When that state recently was forced to spend more than half a million dollars on the reconstruction and repair of a large mileage of main routes damaged by excessively loaded motor trucks, after having been in service only 7 to 10 years, it was decided to put into effect a policy which would definitely safeguard any further capital investments in the state highway system. The result was the passage, last year, of an amended general motor vehicle law limiting gross loads to 20,000 lb.



WEIGHING TRUCK ON PLATFORM SCALES

—a much lower maximum than is allowed elsewhere—and containing other provisions designed to insure a reasonable use of the state's highway system. With this law on the statute books John N. Mackall, chief engineer of the State Roads Commission, in conjunction with the Commissioner of Motor Vehicles, undertook a campaign of enforcement which has resulted in the preservation of existing state roads and a drastic cut in the cost of highway maintenance. The enforcement measures include patrol crews which weigh suspected trucks with loadometers or on permanent road scales, a careful examination of each motor vehicle offered for registration, and measurement of tire widths.

The state highway system of Maryland comprises 1,700 miles of roads out of a total mileage for the entire state, including county and township roads, of 14,810. The principal types of construction on the state system before the enactment of the present motor vehicle law were macadam, surface-treated; concrete; and, in southern Maryland, gravel. It is on this mileage of highways that the State Roads Commission has put into effect its enforcement measures.

Statistics from the Motor Vehicle Department showed that on Oct. 30, 1920, the motor vehicle registration was as follows:

| | |
|---|---|
| Private passenger cars (pneumatic tires) | 101,125 |
| Cars to hire (pneumatic tires) | 3,784 |
| Dealers' cars (pneumatic and solid tires) | 5,222 |
| Motor trucks (solid tires) | 11,194 |

*Motor Vehicle Restrictions*—With regard to solid-tire motor vehicles the main provisions of the law are as follows: Maximum gross load, 10 tons; maximum load per inch width of tire, 650 lb.; maximum width of vehicle, except traction engines, 90 in.; maximum rated carrying capacity, 5 tons. For motor trucks equipped wholly or in part with solid tires the speed limits are 25 miles per hour for 2-ton gross loads; 15 miles an hour for gross loads between 2 and 6 tons; 12 miles per hour for gross loads exceeding 6 tons.

One provision of the law is particularly significant. It reads as follows: "No motor vehicle shall be operated with a greater load than that for which a registration certificate has been issued and fee paid." Before the amended law was passed the manufacturers' rated capacity of a motor truck was taken as the basis for the registration fee. It sometimes happened that a manufacturer would attempt to circumvent the law by rating a truck at, say, 2 tons, at the same time giving to the purchaser a tacit guarantee of a 3½-ton load-carrying capacity. Under such circumstances what amounted to a 3½-ton truck was masquerading under a 2-ton load plate. Such practices, however, have been done away with by the restriction of the load to the rated capacity. While a 3½-ton truck can still be rated at 2 tons by its makers, the purchaser cannot benefit, as formerly, by this subterfuge, as he is now limited to the load indicated on the plate of his machine.

### Registration Fees

For automobiles with pneumatic tires, for private use, the registration fee is 60c. per horsepower, while pneumatic-tired vehicles for hire are charged $1.20 per horsepower, with a minimum charge of $10.

For motor trucks with solid tires the yearly registration fees, for the capacities indicated, are as follows: 1 ton, $20; 2 tons, $40; 3 tons, $60; 4 tons, $100; 5 tons, $150; 6 tons, $300; 7 tons, $500.

Trailers, if equipped with rubber tires, are charged $10 for the first ton and $20 for each additional ton; if metal tires are used the foregoing fees are doubled. Traction engines or tractors used for hauling are charged a flat fee of $25.

The 6- and 7-ton trucks provided for in the foregoing registration fees are those owned in the state before the amended vehicle law went into effect and are subject to the 10-ton gross load limit. Now, trucks with a rated carrying capacity exceeding 5 tons are ruled off the road, for the law states that "no motor vehicle having a greater rated carrying capacity than 5 tons shall be operated over any public highway in this state, these provisions being absolutely necessary in the opinion of the General Assembly for the proper protection and continued maintenance of the public highways of this state." The actual weights and rated carrying capacities of all trucks are recorded by the motor vehicle commissioner at the time of registration and the machines are properly tagged.

An unusual feature of the field work of inspection is the measurement of the width of the tire in actual contact with the road. This width is determined by running the truck over smooth steel plates on which an impression of the wheel track is secured by white paper

and carbon sheets such as are used in making a copy of a typewritten letter; 650 lb. per inch width is the maximum for solid rubber tires.

For enforcing the motor vehicle restrictions two permanent road scales, each of 20 tons' capacity, have been installed, one on the highway between Baltimore and Philadelphia, and the other on the Baltimore-Washington Boulevard. In conjunction with them a crew of four men—two inspectors and two laborers—equipped with a light automobile and four loadometers, or portable jacks, operates along the different state routes, stopping and weighing any truck which appears to be exceeding the load limits. These inspectors are vested with proper police authority and are generally accompanied by a state policeman, in uniform, deputized by the Motor Vehicle Commission. Experience in this work has demonstrated the desirability of having the weighing crews accompanied by a *uniformed* officer. Without this indication of authority the stopping and weighing of trucks was often delayed by disputes. With the permanent road scales a vehicle is simply run onto the platform and its weight recorded.

When the crew with the mobile weighing devices first started operations it was customary to jack up one wheel of a truck at a time and record the weight. Many truck drivers, however, seemed to think that this method did not furnish a fair test, suspecting some form of deception on the part of the state's inspectors in fixing the recorded load at more than its actual amount. A few experiences of this sort led to a change in policy and to the simultaneous use of four jacks, one at each wheel, by means of which the truck is lifted clear of the road surface. No objection to the determination of the load at the four points in this way developed.

WHEN LOADOMETERS SHOW OVERLOADING EXCESS WEIGHT IS REMOVED AND DUMPED AT ROAD SIDE

### Excess Loads Removed

By frequently changing the roads on which the weighing crew operates an element of uncertainty is introduced which tends to prevent infractions of the law.

Originally, when a truck was found to be overloaded, the driven was arrested, sent before a magistrate and fined, the fines generally running from $5 to $25. This method of enforcement did not produce the results desired. A case in point is that of a large company owning a fleet of 107 trucks operating between Boston and a point west of Maryland. The route used was the National Pike through Cumberland. These trucks carried loads of 7 tons and themselves weighed 6 tons, or a total of 13 tons on the highway. Fines of $50 were imposed for overloading and the trucks were sent to the nearest railroad point where the surplus was taken off and shipped to Boston by rail. The imposition of these fines, however, failed to stop the excess loading. A different policy was then adopted. A weighing station was established and trucks carrying more than 5 tons were compelled to discharge the excess merchandise on the roadside, instead of taking it to a railroad station as formerly. It then became necessary for the operating company to send out another truck from its headquarters 17 miles away to pick up the discharged load. After two trucks had been handled in this way the overloading stopped.

Profiting by this experience the State Roads Commission for some time past has been insisting upon the discharge of excess loads *at the roadside*. The campaign was begun last September and during the first week 60 trucks were held up and fined from $10 to $100. The weighing crew, during the next week, selected a different road and caught 70 overloaded trucks. During the fifth week, however, the number of violations had been reduced to 3 a week, and in the sixth week only 1 truck was found to be carrying more than the legal limit. For several months past the average number of overloaded trucks detected has been less than one a day, and these usually for insufficient tire width. Loads greater than 10 tons have practically disappeared.

Mr. Mackall reports that during the last two years there has not been a single road failure. There has also been a marked falling off in the demand for 5-ton trucks. The solution to the problem of road damage by excessively loaded vehicles, the State Roads Commission has found, is to legislate such vehicles off the roads rather than attempt to gain this result by taxation alone. In 1919 it was found that a $500 yearly registration fee was not sufficient to keep 7-ton trucks off the highways. Accordingly when the amended bill in 1920 was passed, it carried a definite load-carrying limit of 5 tons.

The enforcement of a vehicle law can be made effective only with complete co-operation between the state highway officials, magistrates, justices of the peace, and other representatives of the law. Fines for overloaded vehicles now vary generally from $5 to $25, but as previously noted the commission has found that the greatest deterrent to excessive loading is the removal of the excess load on the roadside.

It is of first importance also, according to the Maryland experience, to seek the co-operation of civic bodies, such as chambers of commerce, business men's organizations and automobile clubs, in carrying out the enforcement measures. Mr. Mackall has made it a point to appear frequently before meetings of such organizations and especially to enlist the support of the automo-

bile owners. The broad question involved is one of economical highway transport—not roadbuilding or maintenance of motor vehicle operation, considered individually. The commission's policy is not one of ruling motor trucks off the roads, but rather of insisting upon such reasonable restrictions as to give the entire state the maximum value of its highway system as a transportation agency.

Mr. Mackall believes that the claims for greatly reduced transportation charges by the use of extremely large motor-truck units are generally greatly exaggerated. Recalling that Maryland had to spend $600,000 to repair roads rendered useless by a comparatively few excessively heavy trucks, he believes that, in the year prior to the passage of the amended vehicle law, if all loads on 5-ton trucks had actually been carried on 3-ton units the loss to the operators would not have exceeded $15,000. This amount, insignificant in comparison with more than half a million dollars required to rebuild the state highway system, is cited to support the policy of vehicle load restrictions now in force.

Considering the subject in its economic aspects the position of the Maryland State Roads Commission may be stated thus: If it can be demonstrated that trucks larger than those of 5-ton carrying capacity are able to justify themselves by effecting a saving in transportation costs equal to or greater than the interest and amortization charges for highway bonds plus extra costs for maintenance, and increased widths and thicknesses of road surfaces, then, and only then, should they be permitted. This saving cannot be demonstrated by subjecting roads to loads which they cannot carry.

## Financial Statistics of Cities

In all but four of the 227 cities having a population of over 30,000 in 1919, according to advance figures from a bulletin on Financial Statistics of Cities soon to be issued by the Bureau of the Census, the revenue receipts exceeded the payments for current governmental expenses and interest while in 117 (52 per cent) of these cities the revenues exceeded the entire expenditures of the year for all governmental costs, including interest and outlays. The corresponding figures for 1918 showed that the revenues exceeded total expenditures in 80 cities or 35 per cent of the cities covered by the 1918 report.

The total governmental expenditures in 227 cities for the year 1919 were $1,233,111,835. This amounts to $35.58 per capita, divided as follows: For expenses of general departments (legislative, executive, and judicial establishments, schools, police and fire departments, sanitation, etc.), $21.75; for capital outlays, $7.38; interest on indebtedness, $4.52; expenses of public service enterprises (water-supply systems, electric light and power systems, docks, wharves, landings, etc.), $1.92 per capita.

The largest item of revenue except taxes was that from public service enterprises which totaled $127,399,258, against expenses of $66,700,066, thus leaving a net revenue of $60,699,192, or $1.76 per capita. Of the total revenues from public service enterprises nearly 80 per cent, or $95,304,064 was from water-works.

The net indebtedness of the 227 cities was $2,697,551,844 or $77.82 per capita. Of this total, $1,009,309,052 is owed by New York City, and $141,761,941 by Philadelphia, the second city on the list.

# Some of the Engineering Aspects of Public Health

### Hygiene for the Physician, Sanitation for the Engineer—Many Leading Health Officers Trained as Engineers

By James A. Tobey
Washington, D. C.

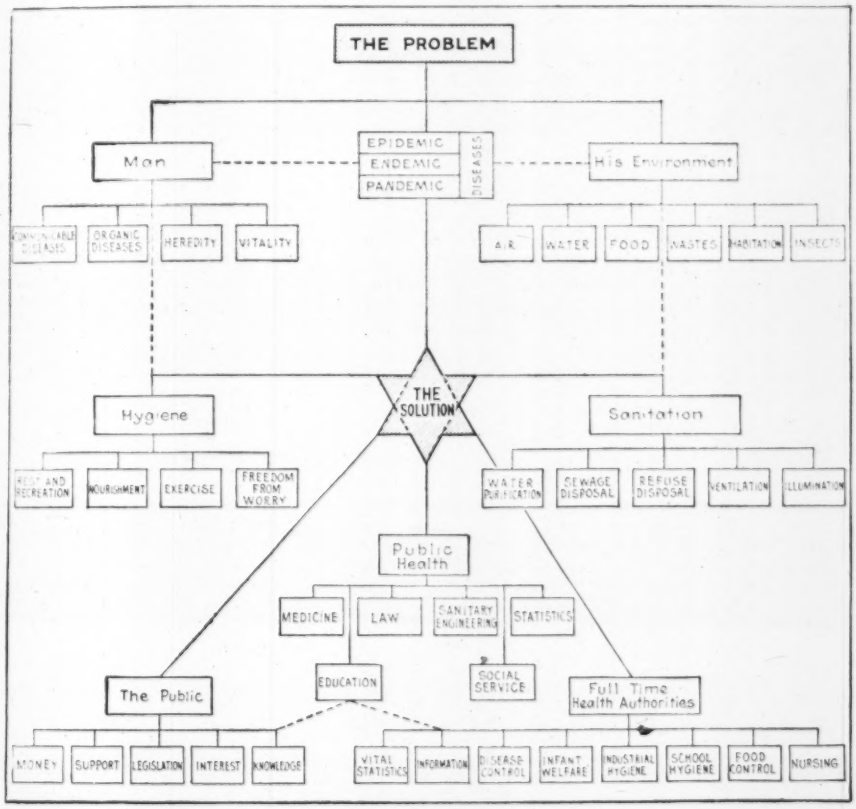
THE popular conception of the science of public health is that it is entirely a branch of medicine. This idea has prevailed in the past and even persists today, though to a lesser degree. *Engineering News-Record*, in an editorial in its issue of Sept. 2, 1920, remarks: "Once the doctors will point the way, engineers will do their part, if fortunately there is a part for them, to make the world as safe against influenza as it now is against cholera and typhoid and may be made with the engineer's help, against malaria." Possibly this editorial means the term "doctors" to apply not only to doctors of medicine, but also to doctors of science, of philosophy, and engineering. At any rate, public health is not a medical monopoly, essential as is the art of preventive medicine in safeguarding the health of the people. Engineering, especially sanitary engineering, plays an important part in public health and the achievements of engineers have had a notable effect on the progress of hygiene and sanitation.

Statements that public health depends for its success as much on engineers as physicians coming from an engineer may seem biased. Many of the leading medical men of the country take a similar view, however. In an address before the Joint Annual Conference of the Council of Medical Education of the American Medical Association with the Association of American Medical Colleges and the Federation of State Medical Boards of the United States, Dr. Victor C. Vaughan, dean of the Medical School of the University of Michigan, made these significant statements:

The trend and spirit of medical schools is toward curative medicine. The graduates of our best medical schools today are not fitted to do public health work. The committee recommends that an improvement be made in this direction. During the last two or three years the National Board of Medical Examiners, examining graduates from Class A schools only, and the very best graduates of those schools, has scarcely found men who could get a passing mark, in preventive medicine, although there have been excellent marks in surgery, medicine and the specialties. It is a matter for consideration whether the medical profession should fit men for preventive medicine or turn the job over to somebody else. The sanitary engineer as an all around man is better fitted as an epidemiologist than the average physician. A number of medical schools are now offering courses in public health. They have a very precarious exixstence. The best public health courses are given at Harvard and at the Johns Hopkins schools, and in neither of these places is the attendance large enough to justify the existence of the school. The regulations of most of the states and many municipalities have been changed so that a medical degree is not required for health officers. Some of the best municipal health commissioners today are not physicians. In our opinion the tendency in all medical schools is to teach curative medicine, not prevention. The committee recommends that we insist that medical men who are fitting themselves for health officers should take an additional course of not less than two years. Even to make proper medical men we need more hygiene and preventive medicine in the medical course than we have. We recommend that five hours a week for one year be devoted to preventive medicine—double the amount of time we are now giving to this branch—and we do not expect to make ex-

pert epidemiologists in this way, but possibly we can give what the ordinary practitioners need.[2]

The first school in America to make a systematic attempt to train health officers was the School for Health Officers of the Harvard Medical School and the Massachusetts Institute of Technology. Here was a combination of medicine and engineering and this school has been successful and turned out many capable health officials. Its students include both doctors and engineers. Dr. William H. Welch, one of the world's foremost medical men, has publicly[3] stated that any argument that non-medical men can not administer in the field of public health is refuted by the accomplishments of those engineers and other laymen who have already administered in this field. The School of Hygiene and Public Health of Johns Hopkins University, of which Dr. Welch is director, admits non-medical men as candidates for degrees. In fact, of the fourteen institutions now giving degrees in public health, all but two make provisions for non-medical men as students.




THE PUBLIC HEALTH PROBLEM AND ITS SOLUTION

In order to understand why the non-medical may qualify in public health, it is necessary to consider what this science, for it is a science in itself, comprises. Prof. C.-E. A. Winslow, head of the Department of Public Health at Yale, and himself educated as a sanitary biologist, has given perhaps the most comprehensive definition. He says:

> Public Health is the science and the art of preventing disease, prolonging life, and promoting physical health and efficiency through organized community efforts for the sanitation of the environment, the control of community infections, the education of the individual in principles of personal hygiene, the organization of medical and nursing service for the early diagnosis and preventive treatment of disease, and the development of the social machinery which will ensure to every individual in the community a standard of living adequate for the maintenance of health.[4]

There are two main factors in the spread of disease, man and his environment. To deal with man we have hygiene, which is a personal thing; to cope with the environment we have sanitation, which is a public responsibility. Obviously, the problems of hygiene belong to the physician, whereas those of sanitation come in the domain of the engineer. But public health includes other factors, too. Besides medicine and engineering, there is education, law, statistics, and sociology. In the accompanying chart are represented the various components of this science. It is a notable fact that we owe most of our modern developments in public health to the wonderful work of Louis Pasteur, who was primarily a chemist.

The engineering aspects of public health are many. They include the development of pure water supplies, the proper and safe disposal of excreta and wastes, ventilation, illumination, safety engineering and other phases of industrial sanitation, housing and city planning, malaria control, and finally public health administration itself. These aspects of public health and in fact, all branches of sanitation, have concerned the world since the dawn of civilization.[5] That they may concern all nations so that world-wide sanitation may in the future be not only a possibility but a probability and an attainment to be expected is the plea of Prof. George C. Whipple, lately chief of the Department of Sanitation of the League of Red Cross Societies.

The value of pure water is too obvious to need much discussion. The practical eradication of typhoid fever, notoriously a water-borne disease, stands as a monument to the genius of engineering. Cholera and dysentry, other types of water-borne diseases, are on the way to extermination. Sewage treatment and the disposal of waste is of equal importance. The biggest problem of rural sanitation especially, is that of the safe disposal of human excreta. Industrial hygiene and sanitation is, broadly speaking, just beginning. There are many problems in it for the engineer, such as the proper ventilation, illumination and sanitary facilities of shops and factories and the safety of the employees. These are all questions of environment. The matter of safeguarding against industrial hazards is perhaps more in the field of the mechanical engineer than any other. Housing and city planning are factors of importace to the health of the people. With the present day interest in the prevention of the possible spread of plague, rat-proofing

of dwellings and of municipalities themselves is an engineering responsibility. The control of such diseases as malaria and yellow fever is essentially an engineering problem. It was sanitary engineering which made possible the Panama Canal and alongside of the administrative success of Gorgas must be placed the engineering qualities of Le Prince.

### A Field for the Trained Engineer

Finally, public health administration itself is a field for the properly trained engineer. Of course, mere graduation as a sanitary engineer does not fit a man to be a health officer any more than does the mere possession of a medical degree. But the specially trained engineer who has a knowledge of pathology, epidemiology and other branches of preventive medicine has a big place in public health administration. Many of our leading health officials are such trained men and include the chief of the Bureau of Health of Philadelphia, the health commissioner of Detroit, the special health commisioner of Delaware, the health officers of Dallas, Texas, and a long line of health officers in Montclair, the Oranges and other New Jersey communities. As a matter of fact the first and one of the leading textbooks for health officers was written by an engineer.

During the war the government realized the value of the assistance of non-medical sanitarians and so established the Sanitary Corps, which was originally composed of engineers, bacteriologists, sanitary chemists and nutritional experts. The U. S. Public Health Service also made provisions for sanitary engineers in its personnel. State departments of health have recognized the importance of engineering in their work, so that there are now twenty-five bureaus of sanitary engineering in states; among these are included all of the more progressive state health departments. At the Conference of State and Provincial Boards of Health in Washington, D. C., last May, the sanitary engineers were in attendance and in some cases, as from Pennsylvania, the engineer was the representative of his state. The League of Red Cross Societies has also established a Department of Sanitation as part of its program of fostering international health.

To recapitulate, public health is a science in which engineering plays as important a part as any other profession. Public health comprises medicine, sanitary engineering, law, education, statistics and sociology. These various elements naturally are more or less interrelated. The ideally trained health official is one who is familiar with all of them. There is so much to be done in the field of public health that there is room for workers from all these various divisions. One important consideration with regard to the control of public health by members of the medical profession is that the physician is at present urgently needed as a practitioner and can not be replaced as such. Certain quacks, faddists and pseudo physicians, such as the osteopaths, chiropractors and naturopaths, seem to think otherwise, but in any alignment between these half baked therapeutists and those whom they impertinently call "allopaths," the engineer strongly supports the regular physician. The doctor can be adequately replaced as a public health official, but no one can take his place as practitioner. In public health the physician and engineer are colleagues; there is and should be the spirit of closest co-operation and mutual respect. Both are working for the welfare of humanity, and both are essential to the great ideal of a better and stronger race.

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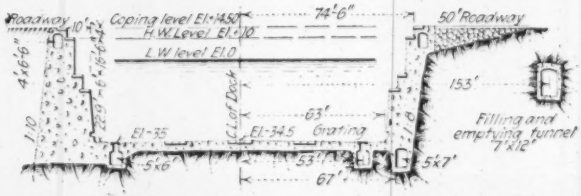
## Canadian Government Dry Dock Being Built at Esquimalt

By J. B. Hunter
Deputy Minister, Canadian Department of Public Works

THE dry dock now under construction in Skinner Cove at Esquimalt, B. C., is being built for the Government of the Dominion of Canada. The general dimensions are as follows: From caisson stop to headwall, 1,150 ft.; width of entrance, on sill, 125 ft., at coping level, 135 ft.; depth on sill, 40 ft. In addition to




TYPICAL CROSS-SECTION OF ESQUIMALT DRY DOCK

the usual caisson berths at the entrance, the dock will have two inner berths, one of which is to be located 400 ft. and the other 750 ft. from the entrance, thus making it possible to accommodate boats of from 350 to 1,150 ft. in length.

The caissons are to be of the ship-floating type and will be made of steel. Stairs leading to the dock floor will be situated at each corner of the dock, and exposed-timber slides at diagonally-opposite corners.

A passenger elevator with a capacity of 4,000 lb. will be installed on one side, near the center of the dock. The dock is to be filled and emptied through one main tunnel and a series of underground culverts, with two lines of gratings, one on each side of the dock and spaced 10 ft. apart. The whole structure will be made of concrete with the exception of the sills, copings, keel block supports, etc., which will be of granite.

A contract for the construction of the work has been awarded to Peter Lyall and Sons Construction Co., Ltd. The design and all drawings and specifications were prepared by the Department of Public Works of Canada under the immediate supervision of Eugene D. Lafleur, chief engineer.

## Panama Canal Slides Quiescent

Curaracha slide into the Panama Canal, which showed a general movement over the entire area from Jan. 1 to 22, inclusive, has since become quiescent says the *Canal Record* of March. 9. Up to Jan. 27, 3,336,400 cu.yd. had been removed from this area since the slide of Feb. 22, 1920. Some material still had to be removed to bring the basin to grade. Culebra Slide showed little movement in January.

# Report on Services and Fees of Practicing Engineers

## A. A. E. Committee Makes Ideal of Efficient Service the Basis for Rules of Practice and Suggests Fee Schedule

AFTER an extended study of fees and services of engineers in private practice, a special committee of the American Association of Engineers has just rendered a report in which it lays stress on shaping all principles of practice to the ideal of efficient service to the client, and proposes a guide schedule of charges for engineering service. Further study of fees is recommended, especially with a view to compiling a list of fee rates actually used and collected the current forms of proposal and contract for engineering services so that ultimately an authoritative code of fees and practices may be prepared. The committee also recommends that to aid in developing sound methods in the field of private engineering practice a separate department of the association be established for interchange of data and news.

### Importance of Service Emphasized

In approaching the subject of proper fee charges, the committee considered the kind and character of service rendered, because "much of the difference in professional practice has arisen from lack of or omission of service in matters upon which the client has difficulty in judging." It states that low fees or free work mean poor service and expresses the belief that the general scale of fees has been held down by artificial causes arising from "the innate modesty of the engineer and certain evils which have crept into professional practice." Engineering fees are declared to be low, compared with those taken by other professional men and financiers, as well as contractors' profits, and do not adequately compensate.

Among the committee's findings or suggestions on service are the following:

• Hazard should be eliminated from the engineer's charges, as definite service has to be rendered. The use of retainers is advocated.

Adequate compensation should be paid by the practicing engineer to his employees. Profit-sharing in engineering offices is worth considering.

The indiscriminate use of such titles as consulting engineer has done harm. A reputable engineer will not hesitate to give his client a complete statement of his qualifications for his particular title.

Manufacturers should not be practicing engineers and should not supply plans and advice to customers.

Engineers should not receive commissions or any remuneration from machinery or materials. Special discounts obtained by the engineer should be credited to the client.

The engineer should not act as engineer and contractor simultaneously on the same job, except in so far as he may execute work as agent for the owner under such arrangements that the interests of the two parties are identical.

It is improper for professors, or engineers in public employ, to take work below current professional rates.

Engineering service is so clearly a matter of individual experience and professional achievement that competitive bidding is incompatible with real service and should be thoroughly discouraged.

No professional man or firm should be required to furnish bonds.

Engineers should refrain from offering their services without charge for the sake of prospective work.

### Suggested Charges for Service

Consulting and expert engineering service, including consultation, arbitration, professional advice, expert testimony and court work, valuation and appraisal, service and efficiencies tests, and reports, are preferably charged for on a per diem basis. "The amount of the charge" says the committee, "should vary according to the character, magnitude or importance of the work or subject involved or according to the experience and reputation of the engineers," from $50 a day upward. A retainer fee of $250 or more may properly be charged. An additional charge should be made for all actual expenses, plus a profit on this portion of the work of at least 25 per cent. Eight hours of office work are to be considered a day, but when absent from the office each 24 hr. away is to be considered a day. Payment for services should be made monthly or upon submission of report or upon completion of work.

MINIMUM PERCENTAGE FEES FOR ENGINEERING SERVICE
(Estimated Cost of Project in Dollars)

| Service Classification | $10,000 to $25,000 | $25,000 to $50,000 | $50,000 to $100,000 | $100,000 to $200,000 | $200,000 to $300,000 | $300,000 to $500,000 | $500,000 to $750,000 | $750,000 to $1,000,000 | $1,000,000 to 1,500,000 | $1,500,000 to $2,000,000 | $2,000,000 and Upwards |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 Surveys | (Actual Cost Including Overhead Plus a Profit of 25% and Upwards) | | | | | | | | | | |
| 2 Preliminary Reports | 2.25 | 1.75 | 1.20 | .80 | .70 | .60 | .55 | .50 | .45 | .40 | .40 |
| 3 Plans and Specifications | 5.00 | 4.50 | 3.75 | 3.25 | 3.00 | 2.75 | 2.65 | 2.60 | 2.55 | 2.50 | 2.50 |
| 4 General Supervision | 2.00 | 1.90 | 1.70 | 1.50 | 1.40 | 1.35 | 1.35 | 1.25 | 1.20 | 1.15 | 1.10 |
| Total of 2 to 4 | 9.25 | 8.15 | 6.65 | 5.55 | 5.10 | 4.70 | 4.55 | 4.35 | 4.20 | 4.05 | 4.00 |
| 5 Resident Supervision | (Actual Cost Including Overhead Plus a Profit of 25% and Upwards) | | | | | | | | | | |
| 6 Purchasing | 2.00 | 1.80 | 1.35 | 1.00 | .90 | .85 | .80 | .75 | .70 | .70 | .65 |
| 7 Management | 5.50 | 5.00 | 4.30 | 3.50 | 3.00 | 2.75 | 2.55 | 2.45 | 2.35 | 2.25 | 2.15 |
| Total of 6 and 7 | 7.50 | 6.80 | 5.65 | 4.50 | 3.90 | 3.60 | 3.35 | 3.20 | 3.05 | 2.95 | 2.80 |

A fixed total sum may be agreed upon in place of the charge by the day. In fixing this sum the per diem charges should be figured as closely as possible.

What the committee calls "regular engineering service" may be made on a percentage basis according to the table herewith. Such work includes surveys, borings, tests, and other preliminary work; conferences, preparation of preliminary plans, estimates and reports; preparation of working plans and estimates; participation in award of contract and general supervision of construction (not including resident engineers, surveys, field inspection or testing); resident supervision of construction; purchase of materials and equipment; complete management of projects, excluding financing.

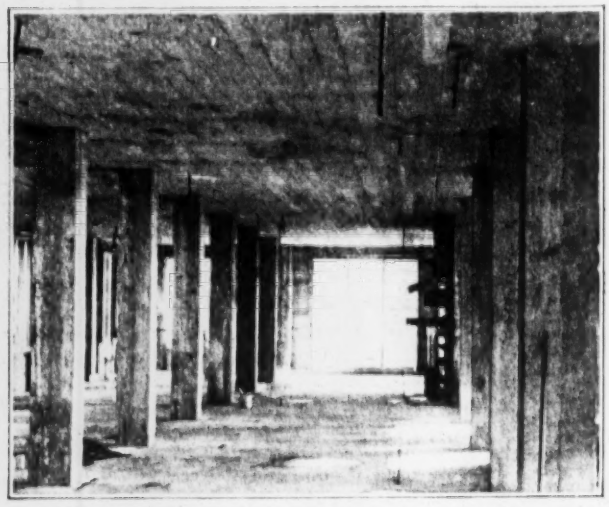
The tabular percentages are to be computed on the cost of the completed work (exclusive of legal and engineering) or (pending execution or completion) the estimated cost. A retainer fee may also be charged.

The committee recommends that an engineer undertaking an engagement should enter into a written contract. Where a specialist is required in connection with an engineering engagement, the cost of the specialist shall be paid by the client. This includes the cost of testing and inspection of materials at factory. Drawings and specifications are to be considered the property of the engineer, but the client is entitled to receive a reasonable number of complete records of them.

# Flat-Slab Floors Built Without Drops or Capitals

## Uniformity of Panel Spacing and Duplication of Detail Result in Economy for Seven-Story Building

BECAUSE a comparatively small sum was available for constructing a nurses' home in San Francisco, effort was made to work out a design that would afford the maximum space at the lowest cost. The problem was simplified by the fact that only light live-loads had to be provided for and as the building was for dormitory purposes, uniformity of room sizes was permissible. A design for which exceptional economies in space and cost are claimed was accordingly developed for a seven-story flat-slab reinforced-concrete building. Features of the design are the absence of capitals or drop heads on the columns, and the simplicity and uniformity of the floor layout with consequent economy in formwork. The floor slabs were calculated for a dead-load of 110 lb. and a live-load of 60 lb. per square foot.



TYPICAL FLAT-SLAB FLOOR—NOTE ABSENCE OF CAPITALS OR DROPS

The first step toward making the plans as simple as possible was to divide the building area into equal spaces, making all floor panels exactly alike and continuing the columns from basement to roof without break. The building is 101 x 125 ft. in plan and thirty-six 10 x 12-ft. dormitory rooms about 10 x 12 ft. each, are provided on each floor. The room arrangement was worked out so that the columns occur only in partitions, the column spacings being uniformly 10 ft. one way and 12 ft. 4 in. the other. The only exception to this uniformity of column spacing was in a 50 x 50-ft. auditorium on the first floor, at the bottom of the light shaft. Here the roof was carried on steel girders.

Close spacing of the columns and light live-loads permitted a special system of reinforcing for the 6-in. flat-slab floor and made it unnecessary to use floor beams except around some openings left for stairs or shafts. Hence, no hanging ceilings were necessary and ceiling finish was plastered directly on the bottom of the floor slabs. Allowing 20c. per square foot for a hanging ceiling and 5c. per square foot for a plastered ceiling, the net saving, on this score, was figured at 15c. per square foot. The saving in formwork on a flat slab, as compared to a beamed floor slab, was figured as 3c. per square foot. The use of floor beams would have made it necessary to add 10 per cent to the height of the building.

A cement finish on floors was used as more sanitary and cheaper than wooden floors and with a few exceptions, such as in the auditorium, no wooden floors were used throughout the building. The cement finish was put on as an integral part of the slab and troweled within a few hours after pouring the concrete. It was calculated that wooden floors would have added 20c. per square foot to the cost of the building.

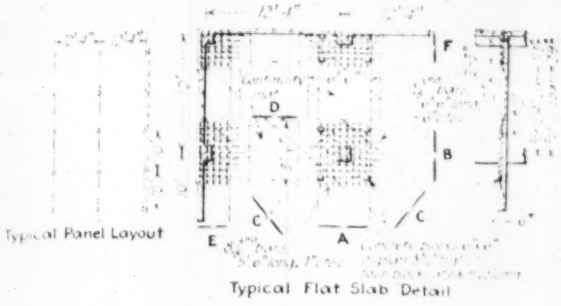
The standard columns were 14 in. square reinforced with straight corner rods and without caps or drop heads. This section provided sufficient area against punching shear due to the live- and dead-load stresses without the use of capital or flare to increase shear area. This feature, which allows the columns to be continued at the same dimensions from floor to the ceiling above, is claimed to afford a considerable saving in the cost of formwork.

The slab reinforcement consists of a combination rod and wire-mesh mat or grillage. As shown in the accompanying drawing, the primary reinforcement consists of a mat of ⅜-in. bars, nine in one direction and eight in the other direction and spaced respectively 6 and 7 in. c. to c., which are placed in the slab over the column and 3½ in. above the bottom of the slab. These bars in the construction were wired together in the material yard and taken up to place in the building as a pre-assembled unit. The units were convenient to handle and were readily dropped over the column reinforcing which projected above the finished floor level, this projection being the amount of the lap of the reinforcing. The mats were supported at the proper height above the deck on pre-cast concrete blocks which became a part of the slab when the concrete was poured.

With the bar reinforcing in place the next step was the placing of the so-called direct bands of wire mesh. These are 52 and 54 in. wide and run at right angles to the columns. They are indicated on the drawings as strips *A* and *B*. They are of wire fabric containing at least nineteen longitudinal wires per band. For the long way of the panel the fabric was 3 x 16 in. x ⅝ and for the short way, 3 x 16 in. x ⅝. These bands pass over the mat of bars at the columns and at a distance 2 ft. 3 in. from the center line of columns they sag toward the bottom of the slab reaching to ¾ in. above the bottom of the slab at a distance 3 ft. 3 in. from the center line of columns. Where necessary the transverse wires were cut to allow the fabric to sag below the ends of the grillage bars.

The third system of reinforcement to be placed consisted of diagonal bands of 4 x 16 in. x ⅝ wire fabric 52 in. wide containing at least fourteen longitudinal wires. These bands passed over the direct band at columns and drop to ¾ in. above the bottom of the slab at the center of the panel.

The last system consists of so-called "continuity mats" of 4 x 16-in. x ⅝ wire fabric 52 in. wide containing at least fourteen longitudinal wires 5 ft. 6 in. long runing the long way of the panel and 5 ft. 6 in. long running the short way of the panel. These mats run across the middle of the span of the direct bands ¾ in. below top of the slab for their full length and




TYPICAL REINFORCING ARRANGEMENT IN FLOOR SLABS

extend equally on each side of the center line of the column. Positive means were taken to maintain these mats in their correct position in the top of the slab. The details of the reinforcement are shown in the accompanying table.

At the edges of the slab all systems of reinforcement were extended into the concrete wall to within 2 in. of the outer face, and for a length of at least 1 ft. were imbedded in the wall.

MESH REINFORCING USED IN THE FLOOR SLAB

| Key Letter | When Placed | Width of Fabric | Size of Mesh | Size of Wire | Number of Wires |
|---|---|---|---|---|---|
| A | After bars | 54 in. | 3x16 | 8 and 10 | 19 |
| B | After A | 54 in. | 3x16 | 6 and 10 | 19 |
| C | After B | 52 in. | 4x16 | 8 and 10 | 14 |
| D | After C | 52 in. | 4x16 | 8 and 10 | 14 |
| E | After pouring concrete | | 4x16 | 8 and 10 | 14 |
| F | | | 4x16 | 8 and 10 | 14 |

All concrete in the structure, from foundation to penthouse, was poured within a period of 64 days, eleven separate pourings being made. Typical floors were completed at the rate of one story per week. Shores were kept in place during the progress of the work for three stories below the pouring. A 1:2:5 mix was used in which the crushed gravel aggregate ranged in size from ¼ to 1½ in.

The building was designed by C. H. Snyder, consulting engineer of San Francisco.

## Calumet Harbor for Chicago

A project for harbor development in Lake Calumet, in the southern portion of Chicago, has been the subject of a public hearing by the council committee on harbors and bridges. The lake is a shallow body of water connected with Lake Michigan by the long and winding course of the Calumet River, both the river and lake being under the control of the Federal Government. Extensive industrial development around Lake Calumet is a part of the project, but there would be facilities also for rail and water terminals and for laying up ships during the winter. According to a report to the city council, prepared by Arend Van Vlissengen, of a real estate firm, the material dredged to form a basin and channels would be used to fill in to low land along the shores, the completed harbor district having 1,450 acres of land and 690 acres of water, of which latter 220 acres would be comprised in slips opening from a large basin. This project is distinct from that of the lake front harbor proposed by Col. W. V. Judson, U. S. A., at Illiana, on the Illinois-Indiana state line, as described in *Engineering News-Record* of Jan. 20, p. 120, but it is considered that both will be needed eventually for the city's development.

# Coaling Station for City Engine Terminal: P. & R. R.R.

### Three Grades of Coal—Operator Handles Chutes—One Hoist Service for Coal and Sand—Large Sand Drying Plant

A LOCOMOTIVE COALING STATION which provides for automatic triple separation of coal for hand-fired and stoker-fired engines, has 600 tons storage capacity, serves engines on three tracks and utilizes the same elevator equipment for both coal and sand, is one of the important items in the improvement of the Philadelphia & Reading R.R. engine terminal at Tulip St., Philadelphia. About 35 engines take coal daily at this plant.

Drop bottom and hopper bottom cars dump the coal into a track hopper from which it is fed through a 2½-ton automatic measuring loader to a 2½-ton bucket in the elevator pit. The cars are moved on a falling grade to and from the hopper by a cable on a nigger head operated by the hoist motor. An adjustable drop gate between the hopper and the loader provides for regulating the charges, and the loader prevents the coal from flowing into the pit when the bucket is raised.

### Automatic Separation of Grades

At the top of the elevator tower, the lower part of the front of the bucket falls forward and forms an apron over which the coal flows to a chute above the coal bin. In the bottom of this chute is a screen 6 x 12 ft. having perforations 2 x 6 in. Lump coal passing over the screen is delivered to one pocket, the finer coal which falls through the screen is delivered to another for supplying locomotives fitted with mechanical stokers. This separation is for bituminous coal. When anthracite is delivered, a by-pass gate at the head of the chute deflects it by a steeper chute to a third pocket. Each of these pockets is of 200 tons capacity. The by-pass gates for the sand and coal chutes are operated by hand chain-hoist, as the man should be over the bin to see the condition in each pocket. A 22-hp. motor operates the bucket hoist, which runs automatically and is started or stopped by push buttons in the hoist house and at a platform above the bin. The elevating capacity is 80 tons per hour.

Two tracks pass under the structure and a third passes on the outside. One engine on each track can take coal of either of the three classes by means of a hinged spout, the enlarged end of the spout being fitted with an undercut gate and hooded apron giving a nearly vertical discharge in order to prevent spilling coal over the tender. These spouts will not be handled by the firemen of the locomotives, but by a station operator who raises and lowers the spouts and adjusts their gates to regulate the supply. An engine can take a full charge of about 15 tons of coal in 45 seconds. No automatic weighing or recording device is used to show the amount delivered to each engine.

### Sand Drying and Supply

An unsual feature is the delivery of sand to the track hopper and elevator bucket which serve the coal pockets. This sand for the locomotive is often delivered in coal cars and is thus somewhat dirty, but the hopper and bucket are cleaned before being used for sand, and all foreign matter is removed subsequently by screening.

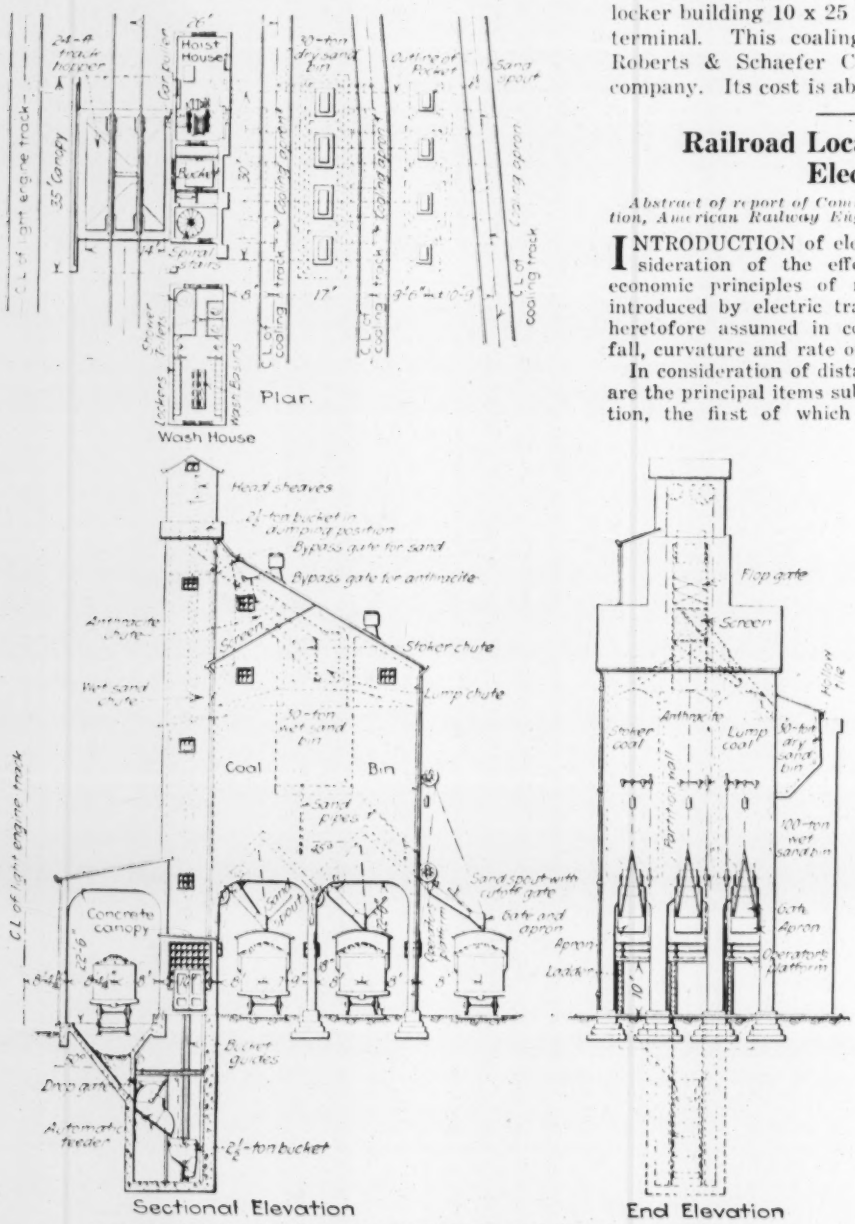
This dupiex service of the hoisting plant is an original design by the builders.

From the elevator bucket the sand is delivered to 100-ton storage pocket flowing by gravity from this through adjustable gates to three sand dryers which are inverted pyramids built up of horizontal steam pipes. The wet sand is held by the pipe walls, but as it dries it flows through the openings between the pipes and falls into steel hoppers, from which it passes through screens to hopper drums. When a drum is filled, it is closed and the dry sand is blown by compressed air at 30-lb. pressure through a 4-in. pipe to a 30-ton elevated bin. This bin is lined with hollow tiles for ventilation.

Pipes 4 in. in diameter lead the sand from this bin to each of the three engine tracks, where they end in hinged spouts fitted with cut off gates to control the supply to the engines. The builders estimate the operating and repair expenses based upon handling 110,000 tons per year, as follows:

| | |
|---|---|
| Coal handling (operating) | 3c. per ton |
| Coal handling (repairs) | ½c. per ton |
| Green sand (operating) | ½c. per ton |
| Drying sand (operating) | 2c. per ton |
| Drying sand (repairs) | 1½c. per ton |

Two men can operate the plant, one attending to the hoist and bins and the other supplying coal and sand to the engines. The building is of reinforced concrete construction. Adjacent to it is a washhouse, toilet and locker building 10 x 25 ft. for the use of the men at the terminal. This coaling station was designed by the Roberts & Schaefer Co., Chicago, and built by that company. Its cost is about $120,000.




RAILWAY COALING STATION SUPPLIES THREE GRADES OF COAL

## Railroad Location as Affected by Electrification

*Abstract of report of Committee on Economics of Railway Location, American Railway Engineering Association.*

INTRODUCTION of electric locomotives necessitates consideration of the effect of electric operation on the economic principles of railway location. New elements introduced by electric traction will affect economic values heretofore assumed in connection with distance, rise and fall, curvature and rate of grade.

In consideration of distance, train wages, fuel and repairs are the principal items subject to variation under electrification, the first of which is little affected. However, an increased charge is made for operation and maintenance of power stations and transmission and distributing systems. The saving in fuel from electrification may be from 50 to 70 per cent, depending upon the class of service, and engine repairs are reduced possibly 50 per cent. But track maintenance will generally be increased due to destruction effect upon track of comparatively large unsprung weight of motors.

Time and temperature limitations of the electric motor and possibilities for regeneration of power on descending grades will affect previously assumed cost due to rise and fall of grades. The value of regenerative braking under proper conditions is considerable, but it does not become economical except on long, heavy grades.

The effect of a change to electric operation as affected by curvature will be in degree rather than in kind, with the possible exception that the shorter rigid wheel base in some types of electric locomotives will result in reduced resistance and wear of wheels and rails.

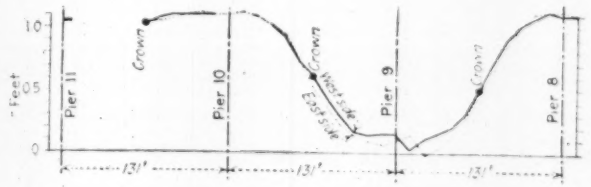
In electric operation the effects of rate of grade and of rise and fall are more closely interrelated than under steam operation. Over lines of moderate grades under steam operation train tonnage ratings can often be determined by average train resistance of the division and the boiler horsepower of the locomotive, rather than by the resistance of maximum grades. But under electric operation the resistance of the maximum grade may become the limiting factor.

# Repair of Tempe Concrete Arch Bridge Damaged by Settlement and Floor Expansion

## Bridge Over Salt River Endangered by Failure of Cylinder Pier Supposed to Rest on Rock—Load Transferred to New Cylinders Sunk Alongside Pier—Cracking of Floor and Spandrels—Expansion Joints

By Merrill Butler
Bridge Engineer, Arizona Highway Department, Phoenix

SETTLEMENT of one pier of the concrete arch bridge across the Salt River at Tempe, Ariz., placed a serious problem before the State Highway Department in the latter part of 1919 and the early part of 1920. The bridge, built in 1911-1913, is a link in the main highway route leading from Phœnix and the Salt River Valley to the eastern and southern portions of the state, and to New Mexico and the East, and is crossed by about 2,500 vehicles per day. It consists of eleven two-rib three-hinged arches of 125 ft. clear span, with open spandrels. The piers were intended to be founded on rock, as stated in a description of the bridge in *Engineering News* of March 28, 1912, p. 578, "on account of the failure of two piers of a large railroad bridge about 500 ft. upstream from the proposed bridge site." Some of the piers were carried to rock in open excavation, but others rest on concrete-filled steel cylinders sunk to rock. It was one of the latter that settled.



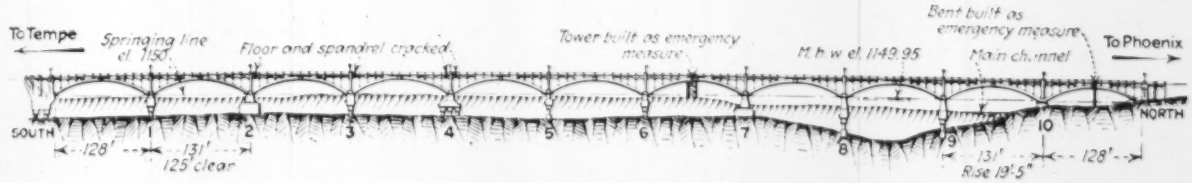




FIG. 1. GENERAL ELEVATION OF TEMPE BRIDGE, AND PROFILE OF ROADWAY IN SPANS ADJACENT TO THE SETTLED PIER NO. 9

Shortly after the floods of Thanksgiving, 1919, the second pier from the north end of the bridge (Pier 9) settled about 4¼ in. Traffic was maintained, except during high water, until Feb. 13, 1920, when a further settlement occurred, about ½ in. A two-ton limit was then placed on the loads permitted to cross the bridge. On March 2 an additional settlement of 1¼ in. occurred, and the bridge was closed to traffic. The following day there was a sudden drop of nearly 5 in. At this time also it was noticed that the pier had shifted out of line about 0.1 ft., downstream.

A profile of the bridge roadway between piers 8 and 10 is shown by a small sketch in Fig. 1, drawn to an exaggerated vertical scale. The sag was strikingly noticeable in looking along the pavement, as in the view, Fig. 2. Evidently the structure adapted itself to the 1-ft. settlement of pier 9 in fairly flexible manner. No evidence of any crack in the floor was found in the region of settlement, although the hand rail was badly cracked; the longitudinal steel in the floor slab probably prevented any serious break in the concrete.

Emergency measures were taken at once to insure the stability of the structure, and the bridge was thrown open to pedestrian traffic on March 4. Material and equipment for sinking cylinders to underpin the defective pier had been in process of being assembled for some time, but repair work could not be started till late in the month as the timber that had been ordered was delayed in shipment. Once begun the work progressed so rapidly that vehicular traffic could be allowed to cross the bridge again on May 11.

### Conditions at the Settled Pier

Prior to the flood of Thanksgiving, 1919, pier 9 was entirely surrounded by sand and gravel, which, being in its undisturbed state, served to carry a considerable portion of the load by way of the base of the pier block (note the pier construction, Fig. 4). The flood swept away all this material and left the pier supported on the two cylinders, which proved inadequate to carry the load. Soundings taken in March, 1920, indicated that except for some thin layers of gravel overlying the bedrock everything had been scoured out. In the light of the difficulties subsequently experienced in sinking the new cylinders it is very probable that the concrete in the bottom of the original cylinders was of inferior grade, or that a foot or so of sand had filtered in after the rock had been cleaned off. The natural consequence would be a crumpling of the steel shells of the cylinders, and this is what actually happened, it is believed. Unbalanced live-load thrust would tend to accelerate such failure.

Other defective conditions in the bridge had also developed, and the plan for the repair work included them. A great number of the spandrel columns were found broken in horizontal shear near the extrados and several spandrel walls near the crown had pulled loose from the arch rings. In the vicinity of piers 2, 3 and 4 the roadway slab and spandrel arches had cracked completely through; in the spans adjacent to these piers none of the spandrel columns were cracked.

There was also trouble at the floor expansion joint. The type of joint used had proved unsatisfactory and large chuck holes had formed alongside each joint, causing serious impact whenever a heavy vehicle passed

FIG. 2. SAG OF ROADWAY OVER SETTLED PIER

over the bridge; in some cases the concrete supporting the wooden strips which bridged the joints was found to be cracked and broken from traffic action. The reconstruction of these joints as well as the repair of the other bridge defects will be mentioned farther on.

### UNDERPINNING THE PIER

In April the channel of the river, scoured out by the November flood, began filling up again, and by the middle of May a considerable deposit of silt and fine sand had accumulated around pier 9. This condition and the desirability of maintaining traffic on the bridge were the main factors of the problem when the state highway department entered upon the repair work in the spring of 1920.

Falsework under the bridge was considered necessary as a safeguard if traffic was to be carried during reconstruction. The department had no steel sheetpiling available, and market conditions were such that none could be obtained for immediate delivery. It was decided to place new cylinders around the old pier, which would allow the underpinning to be done without disturbing the existing structure; it was feared that there was a chance that the pier might tip over if the old cylinders were left without lateral support. The total dead load at the base of the cylinders of pier 9, not allowing for buoyancy of the water, was about 1,650,000 lb. Salt River is subject to sudden freshets, and all work had to be planned to withstand a sudden rise of the river at any time. Fortunately no rise greater than a foot occurred during the whole undertaking.

As already mentioned, emergency provision for holding the structure against further movement was made early in March, when, after a sudden new drop of pier 9, the total settlement had reached a foot. A repair gang was hurried to the bridge and put in a 36-hour shift. About 500 sand bags were thrown around pier 9, in the hope that the bearing would be increased and further scour prevented. Towers were built at the crown of spans 7-8 and 10-11, with the object of saving the remaining portion of the bridge if the two spans between piers 8 and 10 went out; the depth of water in the river prevented the construction of supports any nearer to pier 9. With respect to the arrangement of the temporary supports it should be remarked that the deck of the bridge is continuous over the piers, and has expansion joints at the crowns of the arches only (except as subsequently reconstructed). Since this emergency work no further settlement of the pier has been observed.

Later in the month, in preparation for the underpinning work on pier 9, falsework piles were driven in spans 8-9 and 9-10. These had to be placed outside the side lines of the bridge because the driver leads reached above the deck. Framed bents were erected on these piles, and their caps wedged against the intrados of the arch ribs by oak wedges (Fig. 3); a man inspected these wedges every second day, to make sure that none worked loose under the action of traffic.

Work on a cofferdam around pier 9 was started immediately upon completion of the falsework. It was made up of Wakefield piles consisting of three 2 x 6's, 2 x 8's or 2 x 10's, 20 ft. long, driven by a small steam hammer hung from a pair of short leads mounted on skids. A jet was used to facilitate the sinking, but despite the jet there was considerable difficulty in getting the piles down, owing to the compact nature of the sand.

The general scheme of underpinning is clearly indicated by the drawing in Fig. 4. The work of sinking the steel cylinders began early in July. A small stiff-leg derrick was rigged to handle a 2½-ft. orangepeel bucket, operated from an engine near pier 10. A 40-hp. gasoline engine and a belt-driven 8-in. centrifugal pump were installed on a barge near the downstream side of the cofferdam; this outfit at all times kept the water level below the bottom of the new concrete block.

All of the six new cylinders went down easily with-

FIG. 3. FALSEWORK ON BOTH SIDES OF PIER 9

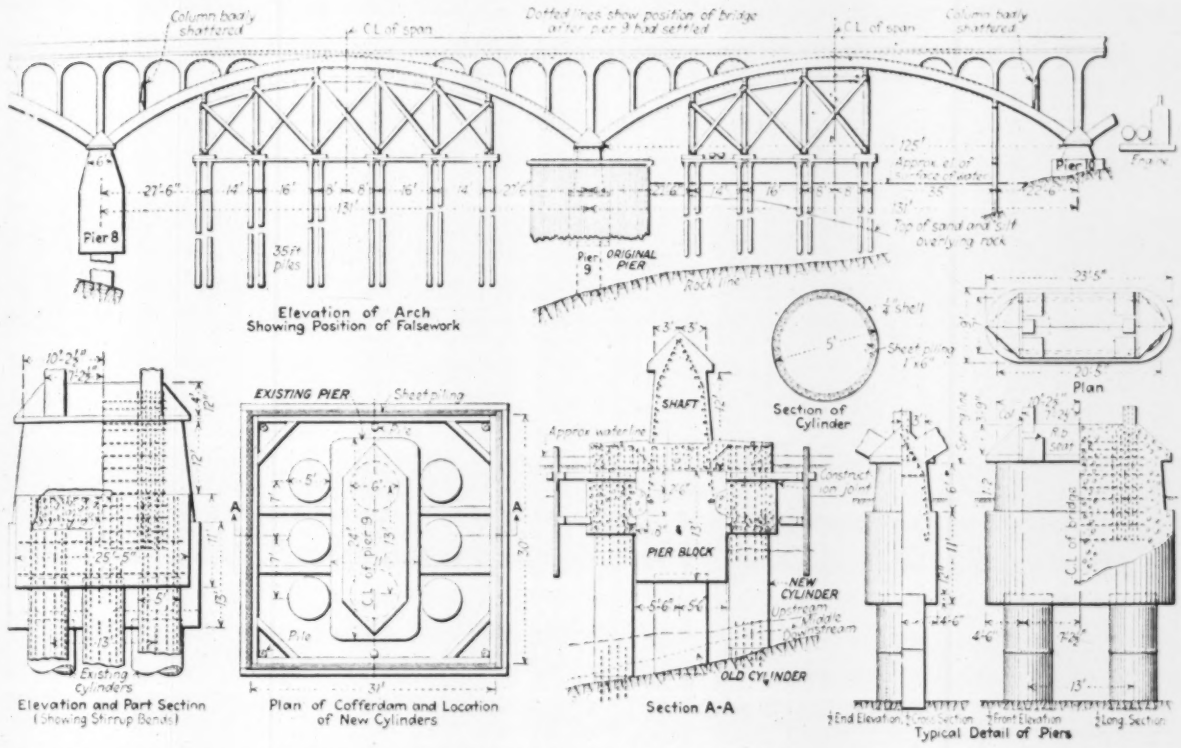



FIG. 4. PIER 9 UNDERPINNED BY NEW CYLINDERS SUNK ALONGSIDE, WITH REINFORCED-CONCRETE BEAM CAP

out loading, until they lodged on logs or branches of trees that had wrapped themselves around the pier during floods. These obstructions caused considerable delay, especially as the fine sand flowed almost with the consistency of water, and it was impossible to pump these cylinders down. Dynamiting was tried, to break up the logs, with little success, and in two cases with rather damaging results, as events proved. Cutting tools of 1¼-in. drill steel were then made up and these proved very satisfactory for getting the timber obstructions out of the way. Cottonwood logs 8 in. in diameter were removed by this means. After this clearing, no difficulty was experienced in getting the cylinders down to rock. Even then, however, the flow of sand was such that it was impossible to reach the rock for cleaning it off and anchoring the cylinders.

To solidify the sand around each cylinder, at least sufficiently to allow the cylinders to be pumped out, grout apparatus was made up and placed on the job. Steam pressure was found to bake the cement until it clogged the 6-in casing; water pressure worked quite satisfactorily. The general scheme of operation was as follows: Grout was poured into the storage chamber after removing the cap, and when the cap had been replaced the water pressure from the pump was turned on. The valve in the 2-in. pipe was kept closed until pressure was on the storage chamber, in order to prevent sand from working into the bottom of the jet pipe. At first considerable inconvenience was experienced from the entry of sand, but by installing the valve and keeping it closed until full pressure from the pump was on the storage chamber the trouble was largely overcome. The bleeder at the bottom of the storage chamber was used to determine when the grout had been forced out.

In some cases the grout set up, but when excavation was continued, a week after grouting, much material of pasty consistency was removed. Evidently where the sand carried a considerable amount of silt the cement had failed to set. The grouting proved to be only partially successful, in no case entirely stopping the flow of sand and water.

Wakefield sheetpiles of three 1 x 6 boards were then driven inside the cylinders by hand, after the sand had been excavated as low as possible with the orange-peel bucket. Once the piles were down to rock, it was possible to pump the cylinders. The sand was then removed, the rock cleaned off, four anchor holes drilled for 1¼-in. square rods set in pairs, and the anchor rods grouted in. The sheetpiles showed little tendency to kick in at the bottom.

When examined, cylinders 1 and 5 proved to be so badly distorted by the blasting tried for removing logs that it was necessary to pull them and sink new cylinders. The seams were broken and the lower sections forced out of round. Blasting had been done with quarter-stick charges of dynamite.

The bottoms of the cylinders were sealed with concrete, and twelve 1-in. square rods were set in place with sufficient lap below the tops of the anchor rods to provide bond. The cylinders were then concreted up to the construction joints just below the cap concrete. The steel shells were cut off at the proper elevation with an oxyacetylene torch. Then the concrete caps were poured, up to the top of the old pier block. After they had set, the existing shaft was cut out in sections and the reinforced beam which transfers the pier load to the new cylinders was poured.

No effort was made to raise the pier or the floor back to the original elevation. The hand rail, however,

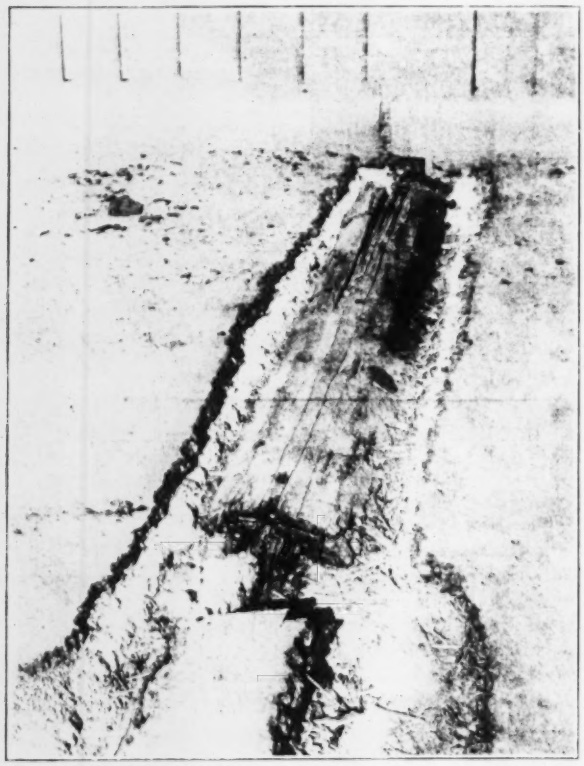


FIG. 5. OLD ROADWAY EXPANSION JOINT

has been rebuilt, to remove the appearance of sag, and it is proposed to take out part of the dip in the floor by filling in with a wood block pavement between crown expansion joints on either side of pier 9.

At piers 2, 3 and 4 the original plans for the floor did not contemplate the use of the longitudinal steel subsequently decided upon and used in the other panels; instead the slab was thickened and longitudinal steel rails were added here. The reinforcing in the center longitudinal beam, however, remained unchanged throughout the construction. These beams were found to be cracked or broken in diagonal tension in four cases, at the three piers in question, and the roadway slab and spandrel arches were cracked substantially as shown on section *MM*, Fig. 4. In two instances these cracks were so wide that a man's little finger could be inserted.

To repair the damage, the old concrete was cut back to the middle of the panel, and a new girder built alongside the old cross-girder, with an expansion joint as shown. Additional stirrups were placed in the longitudinal beams to take care of horizontal shear. During this work all vehicle traffic was excluded from the bridge.

### Renewal of Crown Expansion Joints

As originally built, the floor expansion joints over the crowns of the arches consisted of a beveled strip of redwood spanning the 4-in. gap in the concrete, seated in a properly beveled recess in the floor. This strip was stiffened by another strip attached below as a rib, and was covered with asphalt continuous with that over the concrete. These expansion joints had never been repaired, except for additions to the wearing surface, during the seven-year interval since the bridge was built. Large chuck holes had formed at each joint, Fig. 5, and in some cases the concrete supporting what was left of the redwood filler was cracked and broken.

Experience had shown the impossibility of keeping a satisfactory asphalt surface over an expansion joint supported on both sides of the crown opening. There-

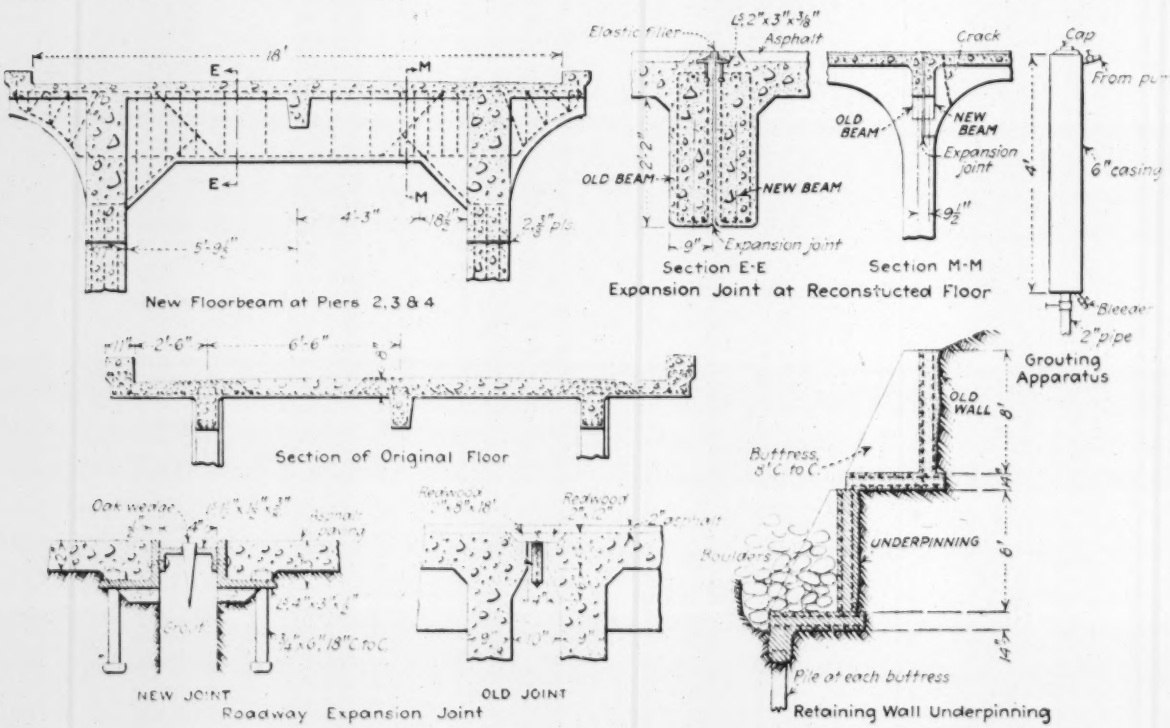



FIG. 6. EXPANSION JOINTS AND FLOOR DETAILS, AND REPAIR SKETCHES

fore the design shown in Fig. 6 was decided upon for the reconstruction. The 1½ x 1½ x ⅜-in. angles are for the purpose of reducing the width of the opening, and are dropped below the general surface of the pavement to prevent their taking much weight from traffic.

One of these new joints has broken out from the effects of stresses to which it was subjected, but has been replaced. Oak wedges have been driven as shown, and these seem to have been of material help, as no other trouble has been experienced at the joints, which have been in service now a little over six months.

UNDERPINNING RETAINING WALL.

The retaining wall adjoining the east abutment was a reinforced-concrete buttress wall founded on gravel. Floods had scoured out the gravel adjacent to this wall until the edge of the footing was exposed and slightly undercut on a length of about 30 ft. It was considered necessary to underpin the wall for a 50-ft. length.

This work was carried out in sections, the gravel bank being utilized as back form. Under the toe of each buttress there is a pile, for added security. The nature of the construction is clearly shown in Fig. 6.

No attempt has been made to repair the broken spandrel columns, as their condition is not considered to involve any direct danger.

The entire work described was carried on under the direction of Thomas Maddock, state engineer, F. N. Holmquist, assistant state engineer, the writer as bridge engineer, J. H. Zeitler as construction engineer during the foundation work, and J. M. Brown in the same capacity during falsework construction and floor repair. All work was done by state forces, and most of the equipment used was state owned.

### Good Scholarship and Engineering Eminence

A close correspondence between good scholarship in college and eminence in engineering is shown in an investigation made under the auspices of the American Association of Collegiate Registrars by Prof. Raymond Walters of Lehigh University, who presents a report in the current issue of *School and Society*. It was found that of 392 distinguished engineers graduated at 75 technical schools, colleges and universities 182, or 46.4 per cent, stood in the highest fifth of their classes scholastically upon graduation, 109, or 27.8 per cent, stood in the second highest fifth, 72, or 18.3 per cent, in the middle fifth, 14, or 3.6 per cent, in the next to lowest fifth, and 15, or 3.8 per cent, in the lowest fifth. Figures for a group of 189 alumni of five Eastern engineering schools were somewhat different in the upper classes, the second highest scholastic fifth having the largest percentage. In all groupings of the eminent engineers there were less than 4 per cent in each of the two lowest scholastic fifths. Of 730 names on the Registrars' Association list of distinguished engineers practically 80 per cent were found to be collegiate graduates, 16 per cent men of secondary school education and practical training, and less than 5 per cent men who started in college but did not finish. The arbitrary basis of eminence in this study of a professional group was taken to be the holding of office, membership in important committees and service as representatives of the four founder engineering societies, civil, mechanical, electrical, and mining and metallurgy, for five years, 1915-1919.

## Allocation of Nile Waters Between Egypt and the Sudan

### Minority Report by H. T. Cory, American Member of the Nile Project Commission, Gives Principles of Water and Cost Division

INDORSEMENT of the immense project for the full utilization and a larger measure of flood control of the Nile advocated by the Egyptian Ministry of Public Works, but with divided opinion as to the allocation of water and cost between Egypt and the Sudan are the outstanding features of the report of the Nile Project Commission (see review, p. 689 of this issue), created early in 1920, whose report was dated in August of that year but not made public until 1921.

Unusual interest for American engineers attaches to this report because one of its three members was H. T. Cory, of San Francisco, Cal. This interest is heightened by the fact that Mr. Cory felt compelled to make a minority report as regards allocation of water and cost between Egypt and the Sudan, in which report he embodied his conception of the fundamental principles that should govern the allocation of water between two countries having a common interest in the same stream, as well as the basic principle for joint action in developing the water supply and distributing the cost of the work between the two countries.

Briefly, the two majority members of the commission—F. St. John Gebbie, inspector general of irrigation in India and head of all the irrigation service in that country, and Dr. G. C. Simpson, since last September head of the Weather Service of Great Britain and before that chief of the Weather Bureau of India—attempted no definite and comprehensive answer as to the allocation of water and cost, but merely proposed that Egypt and the Sudan should each go on with water storage developments already under way—Egypt with the Gebel Aulia reservoir on the White Nile to be formed by a dam just above the junction of the White with the Blue Nile, and the Sudan with the Sennar or Makwar reservoir, being formed by a dam at Sennar on the Blue Nile some distance above Khartum—each country to pay the entire cost of its reservoir and to have the use of all the water stored by it, with relatively minor exceptions and adjustments based upon local conditions.

As to Mr. Cory's proposal for allocation of cost and water the majority members of the commission say:

"With regard to Mr. Cory's report, we feel that while his findings may be theoretically correct it is impossible, on financial and other points, to apply them in present circumstances."

It should be noted that the complete project contemplates a large amount of additional storage and also the construction of a long channel through the Sudd in order that water proposed to be stored in Lake Albert may not be lost in its passage to the Nile proper through what is now a vast overflowed area. It should also be noted that data for the design of these additional works are still lacking. The majority of the commission apparently bases its failure to attempt to allocate water and cost from the ultimate development to a lack of data and to other difficulties. This lack of engineering data and all the other unenumerated difficulties Mr. Cory appears to think do not stand in the way of an allocation of water and cost on broad general principles and to a certain extent upon experience. Mr. Cory also sets forth

in his report figures designed to show that if the Sudan shared half and half in the development of storage in the Gebel Aulia reservoir on the White Nile, and also half and half in the water thus developed, it could irrigate far more land in the Sudan at much less cost than would be possible with the water stored in the Sennar or Makwar reservoir. This, however, is contingent upon the assumption that because Egypt has the benefit of a large volume of the natural flow of the Blue Nile both in Egypt and the Sudan should share equally in the cost of the first additional reservoirs constructed on the two branches of the Nile, the Sudan being allowed to use all of the water from the Sennar or Blue Nile reservoir and to have half of the water conserved by the Gebel Aulia or White Nile reservoir.

For a complete understanding of the position taken by the majority and minority members of the commission either the complete report on "Nile Control," published early in 1920, is necessary or a somewhat extensive abstract of the report. Lack of space prevents giving further details here and at the same time presenting Mr. Cory's presentation of "General Principles" underlying the allocation of water which constitutes the portion of the report of greatest interest to American engineers, and also to engineers in other parts of the world outside of Egypt. In outlining these general principles Mr. Cory introduces, here and there, what might be termed supporting evidence from the Quran or Koran. This portion of Mr. Cory's report is as follows:

There are several kinds of beneficial use which may be made of a stream's water. The most important are navigation, power development, irrigation, human and animal consumption. Broadly speaking, irrigation differs from the other uses in that relatively large quantities of water must be abstracted from, and only a portion can be returned to, the watercourse.

Regarding the beneficial uses of water, the legislation of the Occident, viewed as a whole, appears to start from the primary principle that every riparian proprietor is entitled to make a beneficial use of the natural flow of a stream running through or along his land, in its accustomed channel, undiminished in quantity and unimpaired in quality except as may be occasioned by the reasonable use of the stream on the part of other like proprietors.

This doctrine, however, has had to be abrogated or curtailed by constitutional or statutory amendments or by the effect of judicial decisions whenever found to be unsuited to the natural conditions of a given governmental unit, or inconsistent with the proper development of those industries or those beneficial uses of water which are deemed of paramount importance.

Whenever the rule remains in its pristine form careful analysis will show that either the governmental unit which has adhered to the old system is supplied with a sufficient or evenly distributed rainfall or that its economic welfare is but slightly dependent upon utilizing the water of its streams.

The Orient, on the other hand, has taken the principle that water is public property. It has adhered to but one rule in this regard, which as enunciated by Muhammad is "People are free partners in three things, water, vegetation which springs spontaneously from the soil, and fire."*

In some portions of the Occident there is not an evenly distributed or sufficient rainfall, and as the development of these portions proceeded the emancipation from the thraldom of the "riparian ownership" principle took place or is taking place. A usual change is to the doctrine of "prior appropriation." This rule of "first in time, first in right" implies that one who appropriates water is entitled to the full amount appropriated to the exclusion of all subsequent takers, the capacity fo the first appropriator's channel fixing a limit beyond which he must not go in taking water but up to which he is *prima facie* entitled to take.

This basis of adjustment works out in practice as long as there is in the stream a surplus of unappropriated water. A contingency often arises, however, where the potential water supply is materially reduced but along the banks there still remain large tracts of arable lands unwatered but irrigable belonging to diffrent proprietors, including the original appropriator, all of whom simultaneously law claim to the unappropriated water supply.

Neither the legislation, the jurisprudence, nor the diplomacy of the Occident has as yet laid down a principle of universal application affording a solution to the problem thus presented.

The original doctrine of "riparian ownership" obviously cannot be resorted to as an initial basis of reasoning.

The rule of "first in time, first in right" fairly recompenses foresight and rewards enterprise. It finds its proper application as long as the potential water supply answers all existing needs. It recognizes vested rights but limits these vested rights, and does not give a "first appropriator" a right of pre-emption upon the "unappropriated" water supply.

The civilization of the Occident has sprung from lands where rain nurtures vegetation and there is ample water for potable and domestic use. The cradle of the Orient is largely a vast desert, redeemed from unproductivity by streams and springs, and therefore, in the very nature of things, the Near East looks upon water as a precious commodity and carefully provides for its distribution.

Thus one naturally turns to the basic legislation of the Orient for a suggestion. The East is a land of parables and the great truths of the Quran are often handed down in the form of parables. When, therefore, the apostles said to Saligh: "*You are* naught but a mortal like ourselves; so bring a sign if *you are* one of the truthful," he said: "This is a she-camel; she shall have her portion of the water and you have your portion of water on an appointed time."†

The word "*shirb*," which is used in the text, according to Maulid Muhammad Ali, the eminent commentator, "signifies either an act of drinking, or a share or portion that falls to one's lot of water, or a watering-place, or a time of drinking, and in law signifies the use of water for the watering of sown fields and of beasts." ‡

And then, again, it is decreed, "And inform them that the water is shared between them; every share of the water shall be attended."§

The tendency of modern Occidental water-right legislation is toward the final results of Oriental experience and a conserving of the natural resources on which depend the permanent prosperity and the equal opportunity of the people in a given governmental unit. The result has been that many recent enactments in semi-humid and arid areas specifically declare that water forms part of the public domain and is in no sense private property.

It is, therefore, the duty of Governments to consider that the use, conservation and development of water must be viewed as a public trust and administered in the interests of the beneficiaries of the trust, and accordingly with due regard to the eventual rights of generations yet unborn.

The principle being accepted, it follows that, in the contingency before cited, the arable lands unwatered but irrigable belonging to different proprietors, including the "original appropriator," enjoy an equitable right to an adequate share of the unappropriated water of a stream.

The proper conservation and development of the water yield from any drainage area will, in general, require the construction of storage or other works which should be located with due regard to the interests of the beneficiaries of the trust aforesaid.

Circumstances may obtain whereby the physical configuration of a governmental unit which comprises within its

*Hadith, complied by Imam Alaa Eddin el Hanafi, Part VI., p. 189, line 1.

†Quran, Sura, The Poets, verses 154-155.

‡The Holy Quran, containing the Arabic text with English translation and commentary, by Maulid Muhammad Ali, Islamic Review Office, Woking, Surrey, England, 1917, cxiii, 1275 pp. p. 436.

§Quran, Sura, The Moon, verse 28.

limits arable land unwatered but irrigable traversed by a stream makes it impossible for the said governmental unit to construct within its own borders such works as may be necessary for the proper conservation and development of the stream flow in question, although it would be physically possible for it to construct such works upon the territory of a neighboring power.

The construction of such works upon the territory of a neighboring power would be a violation of the sovereignty of the neighbor, and they therefore cannot validly be erected except as the result of an agreement.

Should no such agreement exist, and it be desired that certain fundamental principles be enunciated as a basis of agreement, an equitable adjustment can be effected by considering the real nature of the rights of all parties.

Assuming that the consent of the neighboring power has been obtained and that no third power asserts a conflicting interest, it becomes the duty of both high contracting parties to view the stream as an entity, to apply the principle hereinbefore enunciated to the stream as an entity, and to consider that the use, conservation and development of water must be viewed as a public trust and administered in the interests of the beneficiaries of the trust and with due regard to the rights of generations yet unborn.

The two governmental units, viewed thus as joint trustees charged with a common trust, can reconcile the interests of all concerned by acting as a "*bon père de famille*," that is to say, by solving the problem just as would a parent towards the children whose present and eventual interests were committed to his charge.

Such a one would begin by acquainting himself with the genesis, evolution and crystallization of the law in respect to water rights. When he had thus prepared himself the conviction would be borne in upon him that in the Quranic maxims before cited, as well as the experience of the arid and semi-arid Occident, is found the key to the entire subject. He would therefore refuse to look upon a stream as private property but would view it solely as a constituent element of the public domain. He would also keep prominently before his mind the cardinal principle that the right of drawing water from a stream is not, in the last analysis, an attribute vested in the owner of riparian property, but a servitude due to the property itself as distinct from the present owner thereof or those who may inhabit the land at the moment.

In connection with the last clause it may be well to notice the suggestion sometimes made that the allocation of water should be based upon, or at least take into account, the population of the moment. Such an idea is untenable because, first, the vesting of rights to use irrigation water in *individuals* instead of making them appurtenant to *lands* would quickly bring about chaotic condtions; second, with regard to vested rights in general, the number of people in men's families is not considered in their adjustments; and, third, relative populations change enormously in short periods, due to civil and foreign wars and many other causes, and water diversions cannot practically be changed in synchronism—the very essence of water rights is that lands acquiring them should be assured of continual irrigation in future.

He would then require that he be advised:

(1) Of the full amount of water used throughout the various seasons of the year by each high contracting party during the past few years; and

(2) Of the superficial areas of arable lands unwatered but irrigable of each high contracting party within the watershed of the stream and of their irrigation water requirements.

After having verified the respective figures so submitted he would decree that:

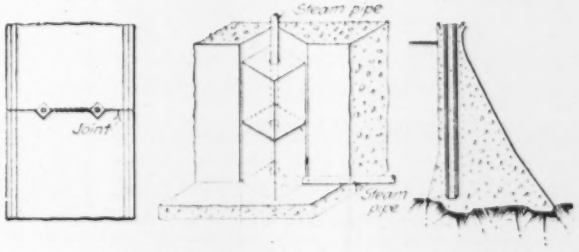
(1) Each high contracting party should be considered as having a vested right in perpetuity to the supply of water when and as beneficially used by it during the past few years.

(2) The unappropriated water possible of use with conservation should be divided among the two high contracting parties so as to in each case permit irrigation of like percentages of the superficial area of arable land unwatered but irrigable and lying within the watershed of the stream.

(3) The cost of all works which may be constructed pursuant to the agreement in question, as well as all maintenance and operation charges in connection therewith, should be shared upon the basis of the quantity of conserved water each shall be entitled to receive, measured at the point of conservation, it being understood, however, that if either high contracting party should not desire or be able to advance its share of the first cost of any conservation work its failure so to do in no sense estops it from eventually participating in the full use of the works aforesaid upon due payment of its proper share of the cost.

## New Stop-Water for Joints in Concrete Structures

A STOP-WATER, or means of sealing joints in concrete structures, recently patented by Francis Betts Smith of San Francisco, has the novel feature of providing for renewal of the seal in case it is broken by settlement of the structure or other causes. The seal is made by asphalt in the form of blocks placed in a vertical groove during construction. After the completion of the structure this asphalt is melted by passing steam through




PLAN AND SECTION OF DAM WITH DETAIL OF JOINT

a pipe imbedded in the blocks, thus allowing the hot asphalt to flow into and fill the joint. Should renewal of the seal become desirable at a later time, the asphalt is again melted and if necessary more is added at the top of the column to replace that which, at the time of the second melting, may flow into the joint.

In making the forms for a concrete face which is to be sealed to the one adjoining, a vertical V-shaped projection is made in the form so that a groove of this shape will be left in the finished concrete face. When the second or abutting section of concrete is being poured against this face, asphalt blocks of square cross-section are placed, half in the groove and half projecting into the new concrete, which is poured around them. These blocks have a hollow core and when they are placed an iron pipe is also put in, passing vertically through the core of the blocks. Short lengths of pipe are added as the work progresses.

The pipe is connected so as to form a U with both ends terminating at the top of the structure. In a thin dam or retaining wall, the two lines of pipe are run in in the same column of asphalt. In dams of considerable bottom-width, the pipe is run horizontally along the bottom and returned to the top in another column of asphalt, not necessarily vertical. Where the two columns are separated by a considerable distance and after the asphalt joint has been made tight by the heating process, grout may be pumped from the top of the structure into the joint between the two columns of asphalt, thus developing the beam action in a straight gravity dam or, in the case of an arched dam, forcing the arch to take its share of the load.

# Effect of Practical Factors on Earth-Pressure Theory

## Many Observed Phenomena Are Due to Cohesion But Designing for Non-Coherent Material Is Conservative Practice

By George Paaswell
Civil Engineer, New York City

IN DECIDING upon the amount of earth presure to use in designing a retaining wall the engineer is perplexed by large discrepancies between the theory on which standard methods are based and various practical facts. The result often is doubt as to the validity of accepted theory, and uncertainty as to how strong a wall he must provide. The present purpose is to show that such doubt is not warranted and that the current methods of dealing with earth pressure are safe and conservative.

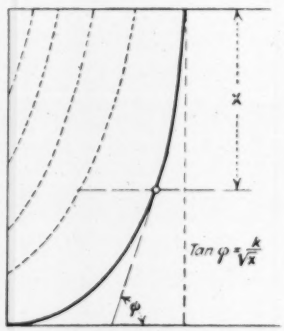
In analyzing earth pressures we instinctively seek an analogy to other structural materials, elastic solids. The analogy is limited, for elastic solids possess continuity, while earth masses are discrete aggregates in which the ordinary stress-strain relations can only be assumed to exist by a highly artificial mechanism; yet it is useful, and probably valid with regard to transmission of high pressures. A verification of this elastic-solid analogy was given by Charles Terzaghi in *Engineering News-Record* of Sept. 30, 1920, p. 632. It leads to interesting qualitative results.

But why do we seek such analogies in place of established theory? The classic theory of earth pressure predicates its formulas upon a granular, non-coherent soil with plane slip surfaces. Such soil, admittedly, occurs but rarely in practice The soils actually encountered comprise (1) recent fills and (2) old fills or original soils cut through, and while the former may often suit the assumptions of the theory the latter do not.

The action of a new fill is exemplified by a load of sand back-dumped from a motor truck. As the body elevates, the material sloughs off with *plane surfaces of slip;* the material then reaches a static condition and no more fill comes away; the driver gives the truck a sudden jerk and the shock sends the rest of the material sliding to the ground. In such material, and generally in any new fill of low height, the plane surface of rupture does exist. But under load, and by the action of time, a fill becomes compacted, and the plane of slip becomes warped. The principal cause of this change is cohesion; it is cohesion that causes the divergence between theory and practice.

Experience data given by H. G. Moulton in a paper entitled "Earth and Rock Pressures" presented before the American Institute of Mining and Metallurgical Engineers a year ago are significant with respect to earth-pressure theory. Mr. Moulton refers to a remark of E. G Haines, some years previously, that earth banks break on the surface a distance back from the edge of the cut equal to one-half the height of the cut, and that rock should show the same behavior if the cut were deep enough. Deep mining in rock makes it possible to test this prediction. Observations on mines, and on deep cuts and tunnel work of the New York subway (for which Mr. Moulton was consulting engineer) supply information on the action of many materials, from rock to moist sand. The general conclusion from the observed facts is that failure of the material is independent of the so-called angle of repose (which for rock would be 90 deg.) and follows generally along the 1:2 break line noted by Mr. Haines.

In moist sand, verification of the conchoidal fracture plane whose extreme points fall within the 1:2 slope is supplied by observation of the limits of street settlement over tunnel work in soil of that character. Verification of the law for gravel banks was obtained by study of placer mining operations. The copper workings in the West illustrate that in deep rock cuts the general law also holds. Thus it may be said to be shown that coherent materials of all types have a similar mode of failure, which is independent of the angle of repose of the material. An explanation of the action of timbered cuts is made on the basis of this uniform law, involving arch action of the soil as described some years ago by J. C. Meem.




FAILURE SURFACES IN COHERENT EARTH

Mr. Moulton has thus brought coherent materials into one general class whose failure surface is, roughly, a quarter ellipse with horizontal offset at the top about one-half of the depth. A similar failure surface may be deduced for an elastic solid, the friction and cohesion elements of soil being replaced by tension, compression and shear, as follows: The maximum tension in a solid is given by any text on mechanics as

$$f = \frac{c}{2}\left[\sqrt{1 + 4\frac{p^2}{c^2}} - 1\right]$$

where $f$ is the maximum tension, $p$ is the unit shear, and $c$ is the unit compression. Since of necessity tension and shear stresses are small in comparison with the compressive stresses, $p/c$ is a small fraction; hence we may expand the radical and drop the terms of higher power than 2, so that,

$$f = \frac{c}{2}\left(1 + 2\frac{p^2}{c^2} - 1\right) = \frac{p^2}{c}$$

Again, the angle that the plane of maximum tension at any point makes with the horizontal is $\phi = \tan^{-1}(2p/c)$, or, in view of the relation just developed, $\phi = \tan^{-1} 2\sqrt{f/c}$. The unit compression $c$ which occurs in this equation is the weight of the unit column of earth above the point in question, or $wx$, if $x$ is the depth below the surface and $w$ is the unit weight of the earth. Substituting this value, $\tan \phi = 2\sqrt{f/wx}$.

Using this equation, curves of maximum tension may be drawn. The curves of maximum tension, however are the curves of possible failure for a material weak in tension. Considering the ratio $f/w$ a constant for the purpose of this calculation—a rough approximation, but of some service—the equation just developed may be used as a differential equation; its integration shows that the surfaces form a family of parabolas, as sketched herewith. They correspond closely to the fracture surfaces of Mr. Moulton.

From a practical standpoint there is no justification in attempting to force the above mathematics any further; the premises will not permit it. But since observed facts as well as this theoretical estimate of the effect of cohesion prove that the slip surface is

curved, while the classic theory takes it as a plane, we are in the anomalous position of founding a mechanics of soil pressure on a type of failure that does not generally occur.

Cohesion varies for different coils and for different parts of the same soil, and also varies with time, degree of moisture, compactness, etc. Moreover, it is changed or destroyed by vibrations, large discontinuities in the soil, or other factors. Thus it cannot be made a definite factor in engineering design.

It is easily demonstrable, and experiments show, that the granular, noncoherent soil theories give the *maximum* lateral earth thrusts, i.e., that the thrust of any coherent soil is less than that calculated by the classic formulas for non-coherent soil. Neglect of cohesion is therefore an error on the side of safety. Moreover, since cohesion has been shown to be an indefinite factor, the engineer must of necessity ignore it, and the use of the granular sliding-wedge theory is consistent and conservative engineering practice.

Undoubtedly there are times when cohesion is a factor that engineering ingenuity may utilize. An excellent example of this is the method used in placing the embankment for the Hell Gate arch approaches, where compactness was secured by ramming while placing the fill, and its permanency was assured by tying the retaining walls together. Here the elasticity analogy might perhaps have been used in determining the lateral pressures; the actual method was to assume that the plane of slip had been made steeper by the compacting.

However, exceptions only emphasize the fact that for ordinary conditions the worst must be anticipated. That the ordinary pressures against retaining walls are nowhere near those for which the engineer has made provision should prove no cause for worry. It is for the extraordinary contingency that designs are made, not for every-day conditions.

One is therefore brought back to the justifiable conclusion that the theory to be used in general for all calculations of lateral pressure computation is a simplified granular sliding-wedge theory with the element of cohesion ignored, as in the classic Coulomb-Rankine methods.

Possible advance in the general theory may be realized by way of the theory of probabilities, as in some recent analyses of substances of unknown detail character, molecular or otherwise. Using the ingenious devices of statistical mechanics, fruitful results have been obtained in the study of gases, for instance (see Jeans' "The Dynamical Theory of Gases"). The method may prove similarly useful in study of soil pressures where the individual grain movements are uncertain.

### City Engineer's Salary $1 for Each Inhabitant

Cranford, N. J., a town of 6,000 inhabitants, has appointed a town engineer at a salary of $6,000 per annum. The town is a suburb of New York and numbers among its residents a great many engineers. These engineers, supported by progressive citizens, urged upon the people the importance of employing a thoroughly competent engineer to plan and supervise the construction work in the town and to safeguard the investment which it now has. The township committee apparently appreciated the force of the argument for it authorized the raising of the salary of the engineer from $3,000 to the amount named. D. C. N. Collins has been appointed to the position.

## 1920 Motor Vehicle Statistics In the United States

By Andrew P. Anderson
Highway Engineer, U. S. Bureau of Public Roads, Washington, D. C.

*The figures given herewith are official statistics compiled by the U. S. Bureau of Public Roads. Slight differences will be noted in some cases between these records and those of the American Automobile Association; published in "Engineering News-Record," Feb. 24, p. 330.*—Editor.

A TOTAL of 9,211,295 motor cars, including commercial vehicles, were registered in 1920 in the 48 states and the District of Columbia. There were also registered a total of 238,146 motor cycles. The registration and license fees, including those for chauffeurs, operators, and dealers, amounted to a total of $102,034,106.

As compared with 1919, the data for 1920 represent an increase of 22 per cent, or 1,645,849 motor cars. This increase alone lacks only about 4 per cent of being equal to the total registrations of the United States for the calendar year 1914. The number of motor cars registered in 1920 in the State of New York (670,290) exceeded the total cars registered in the United States in 1910. Furthermore, the revenues derived from the registrations in the State of New York in 1920 ($8,511,597) were about equal to the entire registration revenues of the United States for the year 1913. The revenues derived from all registrations and licenses during the year 1920 exceed those of 1919 by 58 per cent or a total of $37,336,850.68; this increase is practically equal to the total registration revenues of the United States for the calendar year 1917.

#### Use of Revenues

The increase in the motor car registrations and revenues in the United States during the past 14 years presents many interesting comparisons, especially in respect to the use made of the revenues. In 1906 the total registrations were approximately 48,000 cars, paying a gross revenue of about $193,000, or about the same as that collected by Arizona during 1920. In 1906 the gross registration revenues were equivalent to less than three-tenths of 1 per cent of the total rural road and bridge expenditures for that year, while the registration revenues for 1920 are equal to about one-fourth of the total rural road and bridge expenditures for 1919. Furthermore, while in 1906 practically none of the motor-vehicle revenue was applied to road maintenance or construction, in 1920, 96 per cent, or a total of $97,997,160, was used for this purpose. Of the total amount applied to road work, 79 per cent, or $77,531,582, was expended under the control or supervision of the several State highway departments. The remaining 4 per cent not applied to road work was expended very largely for number plates and in the carrying out the provisions of the motor-vehicle registration laws in the several states.

On Jan. 1, 1921, every state but Minnesota had made provision for some definite form of annual registration. In Minnesota a three-year registration period ended on Dec. 31, 1920. The registration figures for Minnesota, therefore, are the total number of cars registered during the period of three years. How

TABLE I. MOTOR VEHICLE REGISTRATIONS AND REVENUES, 1920

| State | Automobiles | Motor Trucks and Commercial Vehicles | Motorcycles | Total Gross Motor-Vehicle Registration and License Revenues | Motor-Vehicle Revenues Available for By or Under State Highway Department | Motor-Vehicle Revenues Road Work Under Direction of Local Authorities | Average Gross Revenue Return per Motor Car Registration | Population per Motor Car | Motor Cars per Mile of Public Rural Roads |
|---|---|---|---|---|---|---|---|---|---|
| Alabama | 61,941 | 12,696 | 1,035 | $835,178 | $668,142 | | $11 23 | 31 | 1 3 |
| Arizona | 29,868 | 4,733 | 542 | 192,369 | 189,869 | | 5 55 | 10 | 2 9 |
| Arkansas | 59,082 | (1) | | 591,465 | 550,000 | | 10 01 | 30 | 1 2 |
| California | 534,814 | 34,078 | 20,047 | 5,554,265 | 2,777,133 | 2,777,133 | 9 76 | 6 | 9 3 |
| Colorado | 121,506 | 7,749 | 3,420 | 819,873 | 375,699 | 375,699 | 6 34 | 7 | 3 2 |
| Connecticut | 95,123 | 24,011 | 6,543 | 1,852,591 | 1,852,591 | | 15 55 | 12 | 8 5 |
| Delaware | 18,300 | (1) | 674 | 329,980 | 329,980 | | 18 03 | 12 | 5 0 |
| District of Columbia | 29,131(10) | 5,030(11) | 2,648 | 266,285 | | | 7 78 | 13 | |
| Florida | 63,466 | 10,448 | 1,275 | 554,695 | 554,695 | | 7 63 | 13 | 4 1 |
| Georgia | 134,000 | 12,000 | 1,382 | 1,919,339 | 1,851,541 | | 13 14 | 20 | 1 8 |
| Idaho | 50,861 | (1) | 764 | 882,035 | 220,509 | 661,526 | 17 34 | 8 | 2 0 |
| Illinois | 504,250 | 64,674 | 10,569 | 5,915,700 | 5,915,700(2) | | 10 40 | 11 | 5 9 |
| Indiana | 300,226 | 32,841 | 8,823 | 2,029,694 | 1,902,363 | | 6 09 | 9 | 4 5 |
| Iowa | 407,578 | 29,800 | 4,000 | 7,507,202 | 7,244,450(3) | | 17 16 | 5 | 4 2 |
| Kansas | 294,159 | (1) | 3,605 | 1,419,346 | | 1,327,308 | 4 83 | 6 | 2 6 |
| Kentucky | 99,437 | 13,246 | 1,543 | 815,549 | 815,549 | | 7 24 | 21 | 1 9 |
| Louisiana | 66,000 | 7,000 | 512 | 390,000 | | 350,000 | 5 34 | 25 | 3 0 |
| Maine | 55,395 | 7,512 | 1,566 | 818,756 | 818,756(2) | | 13 02 | 12 | 2 7 |
| Maryland | 87,625(4) | 15,216(5) | 5,222 | 2,124,925 | 1,537,540 | 384,385 | 20 53 | 14 | 6 2 |
| Massachusetts | 223,112 | 51,386 | 15,143 | 3,860,232 | 3,506,000 | | 14 07 | 14 | 14 7 |
| Michigan | 366,946 | 45,771 | 8,011 | 5,754,901 | 2,745,715 | 2,737,138 | 13 94 | 9 | 5 6 |
| Minnesota | 324,166(6) | (1) | 7,546 | 143,795 | 143,795 | | 0 44 | 7 | 3 5 |
| Mississippi | 63,721 | 4,765 | 194 | 800,000(13) | 750,000 | | 11 68 | 26 | 1 5 |
| Missouri | 297,008 | (1) | 3,954 | 2,111,697 | 2,111,697 | | 7 11 | 11 | 3 1 |
| Montana | 59,450 | 1,200 | 675 | 416,245 | 280,557 | 93,519 | 6 86 | 9 | 1 5 |
| Nebraska | 200,000 | 19,000 | 2,100 | 2,800,000(13) | 2,100,000 | 700,000 | 12 78 | 6 | 2 7 |
| Nevada | 10,464 | (1) | 125 | 103,318 | 103,318(2) | | 9 87 | 7 | 0 9 |
| New Hampshire | 30,240(7) | 4,440 | 2,542 | 654,702 | 580,342 | | 18 69 | 13 | 2 5 |
| New Jersey | 204,125 | 23,612 | 11,041 | 3,503,937 | 3,441,771 | | 15 39 | 14 | 15 3 |
| New Mexico | 22,100 | (1) | 219 | 200,000 | 180,000 | | 9 05 | 16 | 0 6 |
| New York | 521,417 | 148,873 | 29,453 | 8,511,597 | 6,383,698 | 2,127,899 | 10 16 | 15 | 8 3 |
| North Carolina | 127,405 | 13,455 | 1,418 | 1,785,000 | 1,785,000 | | 10 26 | 18 | 2 7 |
| North Dakota | 90,840 | (1) | 898 | 691,500 | 274,258 | 274,258 | 7 61 | 7 | 1 3 |
| Ohio | 538,090(8) | 83,300 | 23,300 | 6,400,000(13) | 3,100,000 | 3,100,000 | 10 30 | 9 | 7 2 |
| Oklahoma | 204,300 | 8,580 | 1,360 | 2,500,000(13) | 2,294,405(3) | | 11 74 | 10 | 2 0 |
| Oregon | 103,790 | (1) | 3,434 | 2,085,168 | 1,469,145 | 489,715 | 20 09 | 7 | 2 8 |
| Pennsylvania | 521,835 | 48,329 | 23,981 | 8,090,873 | 8,090,873 | | 14 01 | 15 | 6 2 |
| Rhode Island | 40,914 | 9,563 | 2,260 | 531,462 | 468,162 | | 10 51 | 12 | 23 3 |
| South Carolina | 93,843 | (1) | 908 | 527,868 | 92,529 | 329,765 | 5 63 | 18 | 2 2 |
| South Dakota | 112,589 | 7,806 | 777 | 784,000(13) | | 700,000 | 5 51 | 5 | 1 2 |
| Tennessee | 90,214 | 11,638 | 1,151 | 1,215,776 | 571,817 | 571,817 | 11 94 | 23 | 2 2 |
| Texas | 427,693 | (1) | 4,290 | 3,510,356 | 1,468,475 | 1,715,416 | 8 21 | 11 | 3 3 |
| Utah | 37,060 | 5,556 | 1,114 | 350,933 | 325,000(2) | | 8 23 | 11 | 4 8 |
| Vermont | 28,709 | 2,916 | 946 | 555,422 | 515,737 | | 14 40 | 11 | 2 2 |
| Virginia | 101,800 | 13,670 | 2,233 | 1,822,736 | 1,730,931 | | 15 70 | 20 | 2 1 |
| Washington | 144,131(9) | 29,789 | 4,915 | 2,828,896 | 1,800,000(2) | 1,000,000 | 16 15 | 8 | 4 1 |
| West Virginia | 69,862 | 10,802 | 1,659 | 1,280,193 | 1,096,662 | | 15 87 | 18 | 2 5 |
| Wisconsin | 277,093 | 16,205 | 8,002 | 3,127,073 | 2,250,000 | 750,000 | 10 67 | 9 | 3 8 |
| Wyoming | 23,926 | (1) | 327 | 267,179 | 267,179(2) | | 11 16 | 8 | 1 6 |
| Total and average | 8,369,605 | 841,690 | 238,146 | 102,034,106 | 77,531,583 | 20,465,578 | 11 08 | 11 | 3 8 |

(1) Included under automobiles.
(2) To pay interest and provide sinking fund for state highway bond issue; remainder for state highway work.
(3) Distributed to counties but expended under supervision of state highway department; 2½ per cent of grand total, to state highway department for expenses.
(4) Does not include 13,500 non-resident registrations.
(5) Includes 4,022 buses and vehicles used for hire.
(6) Registrations cover a period of three years ending December 31, 1920. Number of cars given are for total period; revenues are for calendar year only.
(7) Does not include 2,359 non-resident and neutral zone cars.
(8) Does not include 2,683 state, county and city cars.
(9) Does not include 1,287 exempt cars.
(10) Does not include 14,797 non-resident cars.
(11) Does not include 1,790 non-resident trucks.
(12) Data cover period of 18 months, ending Dec. 31, 1920.
(13) Approximate.

many of these cars have been removed from the State or have been scrapped there is no way of determining. A few states as yet make no distinction between original registrations and reregistrations or transfers. Consequently, in these states the number of registrations is in excess of the actual number of cars. In most states, however, the registration figures represent fairly accurately the actual number of cars.

For a number of years the general tendency toward devoting an ever-increasing portion of the net motor-vehicle revenues to road work under the control and direct supervision of the State highway departments has been noticeable. Prior to 1912 only a very small portion of the motor-vehicle registrations was devoted to state highways. In 1920, however, 76 per cent of the total motor-vehicle revenues, or $77,531,582 was applied to road work under the direct supervision of the State highway departments, and $20,465,578 additional was applied to road work by counties or other local supervision, but with little or no direct supervision from the State highway departments.

In most states the motor-vehicle revenues are devoted to maintenance and repair of the State roads or other improved highways. These states thus seem to have solved fairly well the difficult problem of securing funds for the maintenance of the more important roads under the ever-increasing traffic requirements. As both the traffic and the revenues increase with the number of cars, there seems to exist a possibility of so adjusting the registration rates as to keep pace with the ever-growing maintenance charges.

A number of states having in general but a small mileage of improved roads have recently adopted the plan of capitalizing the motor-vehicle revenues and devoting these funds to road construction. These states are, Illinois, Maine, Minnesota, Missouri, Nevada,

Utah and Wyoming. In these states bonds have been voted or issued for road construction, and the principal and in some cases also the interest is to be paid entirely from the motor-vehicle revenues. There seems to be no doubt that these revenues may be made sufficient for this purpose. The question as yet to be solved by these states is from what other source can sufficient maintenance revenues be secured so as to prevent the deterioration of the roads constructed from the bond issues.

TABLE II. MOTOR-VEHICLE REGISTRATIONS BY STATES, 1914 AND 1920

| | 1914 | 1920 |
|---|---|---|
| Alabama | 8,672 | 74,637 |
| Arizona | 5,040 | 34,601 |
| Arkansas | 5,642 | 59,082 |
| California | 123,504 | 568,892 |
| Colorado | 17,756 | 129,255 |
| Connecticut | 27,786 | 119,134 |
| Delaware | 3,050 | 18,300 |
| District of Columbia | 4,833 | 34,161 |
| Florida | [1] 3,368 | 73,914 |
| Georgia | 20,915 | 146,000 |
| Idaho | 3,346 | 50,861 |
| Illinois | 131,140 | 568,924 |
| Indiana | 66,500 | 333,067 |
| Iowa | 106,087 | 437,378 |
| Kansas | 49,374 | 294,159 |
| Kentucky | 11,766 | 112,683 |
| Louisiana | [2] 12,000 | 73,000 |
| Maine | 15,700 | 62,907 |
| Maryland | 20,213 | 102,841 |
| Massachusetts | 77,246 | 274,498 |
| Michigan | 76,389 | 412,717 |
| Minnesota | 67,862 | 324,166 |
| Mississippi [2] | 5,694 | 68,486 |
| Missouri | 54,468 | 297,008 |
| Montana | 10,200 | 60,650 |
| Nebraska | 16,385 | 219,000 |
| Nevada | 1,487 | 10,464 |
| New Hampshire | 9,571 | 34,680 |
| New Jersey | 62,961 | 227,737 |
| New Mexico | 3,090 | 22,100 |
| New York | 168,223 | 670,290 |
| North Carolina | 14,677 | 140,860 |
| North Dakota | 17,347 | 90,840 |
| Ohio | 122,504 | 621,390 |
| Oklahoma | 13,500 | 212,880 |
| Oregon | 16,447 | 103,790 |
| Pennsylvania | 112,854 | 570,164 |
| Rhode Island | 12,331 | 50,477 |
| South Carolina [1] | 14,000 | 93,843 |
| South Dakota | 20,929 | 120,395 |
| Tennessee | [1] 19,769 | 101,852 |
| Texas [1] | 40,000 | 427,693 |
| Utah | 2,253 | 42,616 |
| Vermont | 8,475 | 31,625 |
| Virginia | 13,984 | 115,470 |
| Washington | 30,253 | 173,920 |
| West Virginia | 6,159 | 80,664 |
| Wisconsin | 53,161 | 293,298 |
| Wyoming | 2,428 | 23,926 |
| Total | 1,711,339 | 9,211,295 |

[1] State registration only.
[2] Estimated.

At the beginning of 1921, there were still 7 states in which motor trucks were registered at the same rate as passenger cars. The past five or six years, however, have shown a very decided tendency toward increasing the fees required for heavy motor trucks over and above those required for passenger cars. This increase is usually based on the weight of the truck, its carrying capacity, its horsepower, or a combination of these factors. The most general practice seems to be toward definitely limiting the maximum total loaded weight of the vehicle and basing the registration fee on the carrying capacity of the truck. Some few states have adopted a scale of fees which in actual practice serves to make the operation of very heavy trucks unprofitable. A number of states have also provided legislation to limit the maximum wheel load per inch of tire.

TABLE III. TOTAL REGISTRATION OF MOTOR-VEHICLES IN UNITED STATES, 1914-1920

| Year | Registration |
|---|---|
| 1914 | 1,711,389 |
| 1915 | 2,455,664 |
| 1916 | 3,512,996 |
| 1917 | 4,983,340 |
| 1918 | 6,146,617 |
| 1919 | 7,565,446 |
| 1920 | 9,211,295 |

It is unfortunate that the terms motor truck and commercial vehicle are as yet rather indefinitely defined in the laws of a number of the states. In a few states no distinction is made between passenger cars and freight-carrying vehicles, while in one state only trucks used for hire are classed as commercial vehicles.

## Gasoline Tax

Colorado, New Mexico, and Oregon, in addition to the registration fees, also levy a state tax on gasoline or other products used for the propulsion of motor vehicles. In Alabama, Delaware, Idaho, Iowa, Michigan, New Hampshire, New York, North Dakota, Oklahoma, Oregon, South Carolina, Pennsylvania, Tennessee, and Vermont, the registration fees are in lieu of all personal property taxes. In other states, however, motor cars are taxed as personal property in addition to the required registration fees. In comparing the registration rates in the several states this fact should be borne in mind.

The registration of automobiles, motor trucks, commercial vehicles, chauffeurs and operators, dealers, and manufacturers, as well as the total gross revenues and the amount available for state road work, either by the State highway departments or under their supervision and that available for local road work for the year 1920 are given in Table I. The number of registrations in this table does not necessarily indicate the exact number of motor vehicles in use or existence in the several states except in so far as the laws of the several states require and enforce an annual registration under these classifications. All of the states, with the exception of Minnesota, now require an annual registration. Some states, however, do not segregate registrations from reregistration, consequently the registration figures in these states exceed the actual number of cars by the number of transfers which have been made during the year.

It is unfortunate that, during 1920, only 36 states required motor trucks and commercial vehicles to be registered in separate classes. Consequently the data in the third column of Table I do not give a very definite index as to the total number of trucks in existence except in those states requiring separate registration. Even where separate registration is required the classification as to what constitutes a motor truck is far from uniform. A vehicle may be classed as a truck or commercial vehicle in one state where in another it is included among passenger or motor cars for registration purposes

Table II gives a compilation of the total registrations and total revenues for the years 1914 and 1920 inclusive. For further information in regard to registrations and revenues previous to 1913, the reader is referred to Public Roads Bulletin No. 48, Repair and Maintenance of Highways, pages 68 to 71 inclusive, and also to the files of *Public Roads* for the years 1919 and 1920.

# Sanitary Rating of the Indiana Public Water Supplies

*Abstract of Paper Presented to Indiana Sanitary and Water Supply Association by John C. Diggs, sanitary engineer, State Board of Health.*

FROM a recent compilation of data on 211 water-works plants furnishing water to 1,600,000 people in Indiana the State Board of Health has made up a classification of supplies from the sanitary standpoint (see tables). In only 35 plants is the water treated.

Factors used in making the classification are as follows: (1) The source of supply with reference to geologic formations from which the water is drawn and possible contamination by domestic sewage and industrial wastes. (2) The purity of the supply as gaged by chemical and bacterial examinations. (3) The equipment of the water purification plant treating the supply. (4) The character of the personnel responsible for the operation of the water plant.

TABLE I. ALLOCATION OF INDIANA WATER SUPPLIES BY SOURCE AND TREATMENT

| Classes | I | II | III | IV | V | Total |
|---|---|---|---|---|---|---|
| Ground water natural | 98 | 35 | 26 | 2 | 1 | 162 |
| Ground water treated | 0 | 0 | 3 | 3 | 0 | 6 |
| Surface water untreated | 0 | 0 | 0 | 3 | 11 | 14 |
| Surface water treated | 4 | 0 | 12 | 13 | 0 | 29 |
| Total | 102 | 35 | 41 | 21 | 12 | 211 |

With the utilization of these factors five classes of public water supplies were made.

Class I supplies comprise those plants which obtain their water from wells adequately protected not only with reference to general water-bearing formations but to local conditions as well. Such supplies must stand the test of a sanitary survey and of chemical and bacterial examinations. A second group of waters placed in Class I are those from adequately equipped water purification plants, under suitable laboratory control and in charge of technically qualified operators who are also conscientiously disposed to exert themselves to produce safe water.

Class II supplies are ground waters usually of good quality but which have some unfortunately situated suction line, reservoir or well by which contamination might gain access to the city system.

Class III supplies include waters from improperly protected ground water sources, springs, shallow wells, etc., and from purification plants not properly equipped or operated by inefficiently trained men and not under adequate laboratory control.

Class IV supplies include waters obtained from surface sources, impounding reservoirs or ground waters exposed to contamination at times and from water purification plants not properly operated or not controlled by laboratories. These waters are normally of poor quality and are often grossly polluted.

TABLE II. TYPHOID IN INDIANA TOWNS OF VARIOUS CLASSES

| Class | No. of Plants | Population 1920 Census. Total | Served with Water | Average Typhoid Deaths per Year. Total | Rate per 100,000 |
|---|---|---|---|---|---|
| **Rating of All Cities** | | | | | |
| I | 102 | 728,178 | 528,614 | 118.0 | 16.1 |
| II | 35 | 394,941 | 350,210 | 65.1 | 16.3 |
| III | 41 | 364,196 | 303,923 | 70.1 | 19.3 |
| IV | 21 | 112,045 | 102,200 | 41.5 | 37.0 |
| V | 12 | 24,173 | 10,700 | 8.5 | 35.1 |
| Total | 211 | 1,623,533 | 1,295,647 | 303.2 | 18.7 |
| **Supplies for Cities of Over 5,000 Population** | | | | | |
| I | 13 | 568,373 | 422,250 | 70.4 | 12.4 |
| II | 16 | 353,288 | 314,650 | 53.1 | 15.0 |
| III | 14 | 309,522 | 266,500 | 54.6 | 17.7 |
| IV | 6 | 76,439 | 75,000 | 27.0 | 35.5 |
| V | 0 | ..... | ..... | 00.0 | ... |
| Total | 49 | 1,307,622 | 1,078,400 | 205.1 | 15.6 |
| **Ratings of Towns Having Purification Plants** | | | | | |
| I | 4 | 472,059 | 340,500 | 59.6 | 12.6 |
| III | 15 | 288,348 | 245,700 | 54.1 | 18.4 |
| IV | 16 | 102,218 | 100,400 | 36.0 | 35.3 |
| Total | 35 | 862,625 | 686,600 | 149.7 | 17.3 |

Class V supplies are unquestionably bad through the constant contamination by sanitary sewage or other wastes.

Typhoid rates in Table II are from data for 1915 to 1916 for cities having populations of 5,000 or more, and for years 1916 to 1917 for smaller cities and towns.

Though but 35 of the supplies have purification plants they furnish water to more than 50 per cent of the citizens served by public water systems and it is probable that efforts to improve their operation would be most profitable of results. In many cases changes in operation or the addition of personnel qualified to carry on laboratory control work efficiently would result in a vast improvement in the quality of the supply.

For a proper supervision of the public water supplies of the state a routine system of inspection and sampling as follows should be carried out: Class I, inspect annually and make laboratory examination at least semi-annually; Class II, make survey annually and analysis quarterly; Class III, make survey quarterly and analysis weekly; Class IV, make surveys quarterly and analysis weekly or semi-weekly; Class V, surveys are useless except as a means of urging the installation of an improved system.

# Final Values of Four Properties Reported by I. C. C.

## Commission Now Reports Additional Land Costs as Required by Kansas City Southern Decision—Single Total Sums Given

VALUATIONS of the properties of four railroad companies were issued by the Interstate Commerce Commission as tentative final reports, April 5, 1921, termed "supplemental tentative valuations" including statements of the additional cost of acquiring lands over and above the "present values" reported in the previous tentative valuations, as required by the decision of the U. S. Supreme Court, March 8, 1920, in the Kansas City Southern case. The reports now filed also give single sums as final value of properties. It is stated that these sums take into consideration additional costs of acquiring carrier lands, appreciation, depreciation, going concern value, working capital, materials and supplies, and "all other matters which appear to have a bearing on the values reported."

The four reports are on the properties of the Kansas City Southern Ry. System, the Atlanta, Birmingham & Atlantic R.R. Co., the San Pedro, Los Angeles & Salt Lake R.R. Co., and the Winston-Salem Southbound Ry. Co. In the case of the Kansas City Southern, the additional cost of acquiring land, over and above the original "present value," is equal to 95 per cent of the sum previously given as "present value," thus almost doubling the total cost of acquisition. This additional cost of acquisition of land, including severance and condemnation damages, as stated in the present report on the Kansas City Southern properties, amounts of 8.83 per cent of the sum given as final value of the entire system.

In the original tentative valuations the Bureau of Valuation of the Interstate Commerce Commission reported only what was termed "present value of land," largely based on prices, as of the date of valuation, of adjacent lands. In the present supplemental reports what is termed "excess cost" is included as the price railroads would have to pay in addition to the cost of similar adjacent lands due to severance damages, condemnation proceedings and other items in the cost of acquiring land not included in the value of adjacent areas.

The single sum given as final value of the Kansas City Southern is 29.5 per cent more than the figure pre-

viously reported as cost of reproduction less depreciation. The additional cost of acquiring lands and the final value of properties owned by the four companies are reported as follows:

Kansas City Southern, $4,371,970 and $49,485,907; Atlanta, Birmingham & Altantic $1,831,665 and $26,548,250; San Pedro, Los Angeles & Salt Lake $2,504,529 and $45,871,093; Winston-Salem Southbound $468,022 and $5,850,000. Cost of reproduction less depreciation and "present cost" of lands of the Kansas City Southern were previously reported as $38,316,799 and $4,609,377.

Reports as of June 30, 1914, indicate the capitalization of the companies approximately as follows: Kansas City Southern, about $99,000,000; Atlanta, Birmingham & Atlantic, about $54,000,000; San Pedro, Los Angeles & Salt Lake, about $81,000,000; Winston-Salem Southbound, about $5,125,000.

The decision of the Supreme Court, in the mandamus action of the Kansas City Southern System to compel the Interstate Commerce Commission to report on additional costs of acquiring railway lands, was printed in full in *Engineering News-Record* March 18, 1920, p. 563, editorial comment appearing on page 553 of the same issue. The decision stated that the Court was not required to decide "a controversy growing out of duty performed under the statute" but "one solely involving an alleged refusal to discharge duties which the statute exacts." The decision ordered the Interstate Commerce Commission to proceed to carry out the requirements of the Valuation Act to find the so-called "excess" cost of acquiring lands.

In issuing the present "supplemental" reports, the Bureau of Valuation of the Interstate Commerce Commission outlines the method pursued in developing excess cost of land. To meet the requirement of the Act and to report the present cost of condemnation and damages or of purchase in excess of present value it was attempted to show what the expense to a carrier would be of acquiring its common-carrier lands upon the date of valuation, on the assumption that it did not possess those lands, but was obliged to obtain them through purchase or condemnation at the value of similar lands in the vicinity, on that date. It is held that the figure reported could be only an estimate, since the "excess" amount actually paid would depend so much upon individual circumstances and conditions. But so far as possible prices were determined with reference to actual transactions and actual sale by a method developed as an average. While a single instance is not held to be reliable, it may be possible to find many instances putting them together in the form of an average factor and dividing the land into types. By subtracting the present value from the total amount paid the land owner, the excess cost in each case is found, establishing a ratio between such excess and present value. The result is known as the multiple of that individual case and all multiples of a given kind are combined into a weighted average, this average being treated as the multiple of that type.

It is also recognized that there are certain expenses connected with the acquisition of lands besides the money paid to owner, and these are taken into consideration. But the cost represented by interest charges previous to the time of opening for operation of the road is not included since the reports state that "this has been compensated for by basing the estimate on present value of land."

# Federal Highway Policies Stated by President Harding

*The following excerpt from President Harding's first message to Congress, delivered April 12, states his policies with regard to highway financing, construction and maintenance.*

TRANSPORTATION over the highways is little less important [than railway transportation], but the problems relate to construction and development, and deserve your most earnest attention, because we are laying a foundation for a long time to come, and the creation is very difficult to visualize in its great possibilities.

The highways are not only feeders to the railroads and afford relief from local burdens, they are actually lines of motor traffic in interstate commerce. They are the smaller arteries of the larger portion of our commerce, and the motor car has become an indispensable instrument in our political, social and industrial life.

There is begun a new era in highway construction, the outlay for which runs far into hundreds of millions of dollars. Bond issues by road districts, counties and states mount to enormous figures and the country is facing such an outlay that it is vital that every effort shall be directed against wasted effort and unjustifiable expenditure.

The federal government can place no inhibition on the expenditure in the several states, but since Congress has embarked upon a policy of assisting the states in highway improvement, wisely, I believe, it can assert a wholly becoming influence in shaping policy.

With the principle of federal participation acceptably established, probably never to be abandoned, it is important to exert federal influence in developing comprehensive plans looking to the promotion of commerce, and apply our expenditures in the surest way to guarantee a public return for money expended.

Large federal outlay demands a federal voice in the program of expenditure. Congress cannot justify a mere gift from the federal purse to the several states, to be prorated among counties for road betterment. Such a course will invite abuses which it were better to guard against in the beginning.

The laws governing federal-aid should be amended and strengthened. The federal agency of administration should be elevated to the importance and vested with authority comparable to the work before it. And Congress ought to prescribe conditions to federal appropriations which will necessitate a consistent program of uniformity which will justify the federal outlay.

I know of nothing more shocking than the millions of public funds wasted in improved highways, wasted because there is no policy of maintenance. The neglect is not universal, but it is very near it. There is nothing the Congress can do more effectively to end this shocking waste than condition all federal-aid on provisions for maintenance. Highways, no matter how generous the outlay for construction, cannot be maintained without patrol and constant repairs. Such conditions insisted upon in the grant of federal-aid will safeguard the public which pays and guard the federal government against political abuses, which tend to defeat the very purposes for which we authorize federal expenditure.

*(See editorial comment on above, p. 663.)*

# ENGINEERING LITERATURE

## Building Construction Handbook

REVIEWED BY ROBERT W. BOYD
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HANDBOOK OF BUILDING CONSTRUCTION: Data for Architects, Designing and Constructing Engineers, and Contractors, Vol. I and II—Compiled by a staff of Forty-six Specialists; Editors-in-Chief, George A. Hool, S. B., Consulting Engineer, Madison, Wisconsin, Professor of Structural Engineering, The University of Wisconsin, and Nathan C. Johnson, M.M.E., Consulting Engineer, New York City. New York and London: McGraw-Hill Book Co., Inc. Flexible cover; 6 x 9 in.; pp. 1,171 in the two volumes; illustrated. $10 for both volumes (not sold separately).

The two editors-in-chief with their forty-six collaborators have compiled a work which embraces practically every phase of building construction. Under the general caption Design and Construction are presented sections dealing with Elements of Structural Theory, Designing and Detailing of Structural Members and Connections; Structural Data, General Designing Data, Construction Methods, Construction Equipment, and Building Materials. Under Estimating and Contracting are sections on Estimating Steel Buildings, Estimating Concrete Buildings, Architectural Practice, Contracts, and Specifications. The general heading Mechanical and Electrical Equipment covers Heating, Ventilation and Power, Water Supply, Sewage Disposal, Waterless Toilet Conveniences, Plumbing and Drainage, Electrical Equipment, Electric Lighting and Illumination, Gas Lighting, Gas Fitting, Elevators, Refrigeration, Communicating Systems, Lightning Protection and Vacuum Cleaning Equipment.

Like every other book, the value of a handbook depends upon the material which it contains and the way that material is presented. In compiling a handbook the problem is not only to crowd into it every essential element of each subject treated, but also to subordinate or omit all material that is obvious or unimportant so that the salient features presented will stand out in such a way as to be readily found by the user.

In the present work the editors have gathered together in the two volumes a large mass of very valuable material. From a consideration of the ground covered and the material presented this book is probably far ahead of any similar book that has yet appeared. There are few subjects connected with buildings and building construction which are not treated and the architect, the engineer and the builder should find the book of great value for general reference.

There is, however, much matter that could be omitted without impairing the book in any essential particular. For example, it is doubtful if the four pages devoted to cast-iron lintels serve any very useful purpose in this day of structural steel. Again, while the article on school planning contains much detailed information of great value, a large amount of the text has to do with matters only remotely connected with actual school building. In many instances space is devoted to matters so obvious as to require no mention whatever. For example, we are told that "water in excavations or in footings or trenches must be removed by pumping," that "drop hammers are so called because they consist of a weight hoisted to some distance and allowed to fall" and that "hoists . . . are devices of the highest importance to all building operations."

Some of the omissions are hard to understand. Why such a thing as a table of the properties of cast-iron column sections should not be included is not clear. One looks in vain for information relative to the yield of various concrete mixtures, and the quantities of the several materials entering into one yard of concrete.

On the whole, however, the editors are to be congratulated upon the vast store of very excellent data made readily available. The section devoted to Building Materials is particularly noteworthy. The articles on timber, building stones, glass and glazing and stucco are exceptionally good. The inclusion of articles on such subjects as swimming pools, chimneys, domes, architectural design, public buildings and acoustics of buildings will be welcomed by many who heretofore have found it difficult readily to find reference to these subjects. The book gains in value by including the standard specifications for cement, steel for buildings, reinforcement bars, and concrete building stone.

In the arrangement of the material presented the book is open to some severe criticism. It is apparent that in planning the book the editors prepared what they considered a logical scheme and then followed that scheme notwithstanding where it led them. The scheme itself is logical enough, but following it rigorously results in many places in the separation of various parts of the same subject which should be treated together when the point of view of the reader is considered. For example, excavation and pile driving are discussed in general under the heading "Construction Methods" but the reader must jump to another section under "Construction Equipment" to find out what a steam shovel or a pile driver looks like. Again, anyone wanting to refresh his memory on the analysis of stresses in roof trusses is referred to the article on the "General Method of Computing Stresses in Trusses" by Prof. Hool, or to the succeeding article by Mr. Rogers on "Stresses in Roof Trusses." Both articles contain almost the same matter and should be combined.

There seems to be no good reason why "Steel Beams and Girders" should be separated from "Plate and Box Girders" by "Reinforced-Concrete Beams and Slabs" and "Wooden Girders." The book would gain in value if all the material bearing on the same general subject were brought together in the same section. In general the arrangement of the matter in the book leaves much to be desired.

The index, which in a work of this kind should receive the most careful attention, is not entirely satisfactory. Some important matters, for example the *Engineering News* formula for safe loads on piles, found on p. 357, have been overlooked. Many of the references are not sufficiently descriptive.

Taken as a whole, the merits of the book outweigh its defects and the editors and their associates deserve credit for adding to engineering literature a valuable reference work on building construction.

## The Nile Project and Problems

REPORT OF THE NILE PROJECT COMMISSION — [Cairo, Egypt: Adviser, Ministry of Public Works.] Heavy Paper, Cloth Back; 8 x 13 in.; pp. 126; 3 diagrams in text and one on folding plate.

CRITICISM OF THE NILE PROJECTS: Submitted by the Commission of Egyptian Engineers to the Nile Projects Commission. For copies apply to Abdalla Pasha Wahbi, Munira, Cairo. Paper; 8 x 11 in.; pp. 36.

Comprehensive projects for the conservation and utilization of the waters of the Nile have been the subject of much study and controversy for years. On Jan. 10, 1920, the Council of Ministers of the Egyptian Government approved the appointment of a commission to report on the Nile control projects proposed by the Egyptian Ministry of Public Works. The commission consisted of F. St. John Gebbie, M.Inst.C.E., president; Dr. G. C. Simpson, F.R.S., and H. T. Cory, M.Am.Soc.-C.E. Mr. Gebbie is inspector general of irrigation in India and head of all the irrigation service in that country. Dr. Simpson was chief of the Weather Bureau of India at the time of his appointment and since September, 1920, has been at the head of the Weather Service of Great Britain. Mr. Cory is a well-known American engineer of San Francisco who has served as consulting engineer for the United States Reclamation Service.

For a complete understanding of the reports now before us one should have available the report on "Nile Control" by Sir Murdoch MacDonald, adviser, Ministry of Public Works, Egypt, noted briefly in these columns on July 15, 1920, p. 132. In his prefatory notes to the report just mentioned Mr. MacDonald states that the object of all the projects has been "to expand the agriculture of Egypt to its utmost limit by the further utilization of the waters of the Nile, while at the same time developing the Sudan to such an extent as may be possible without injury to Egypt." The portion of the foregoing quotation that relates to the Sudan and its development "without injury to Egypt" should be borne in mind in considering that portion of the Nile Projects Commission report relating to the allocation of water and cost between Egypt and the Sudan. The reason for this will be better understood when it is explained that the three members of the commission were unanimous in approving the engineering features of the Nile project, as proposed by the Egyptian Ministry of Public Works, but were divided as to allocation of water and of cost between Egypt and the Sudan. The two British members of the committee submit a majority report advising that Egypt and the Sudan each go ahead with the construction of reservoirs now under way on the White Nile and the Blue Nile, respectively, each country to have the use of all the water stored in the reservoir built by it. All questions regarding the division of water and cost resulting from the large scheme for future development are left unanswered by the majority of the commission except for some general proposals and minor details.

In strong contrast, Mr. Cory considered it to be the duty of the commission to carry out the clearly apparent intent of sections 2 and 3 of the terms of reference (the first term of reference being to report upon "physical data on which the projects are based") which read as follows:

2. To report upon the propriety of the manner in which, as a result of these projects, the increased supply of available water provided by them will be allocated *at each stage of development* [italics ours—EDITOR] between Egypt and the Sudan.

3. To advise as to the apportionment of the cost of the proposed works under this inquiry as between Egypt and the Sudan.

Acting accordingly, Mr. Cory submits an analysis and argument of some twenty printed pages on the second and third terms of reference, together with a definite plan for the division of the waters developed and the cost of the necessary construction works. Some further particulars regarding Mr. Cory's plan, the whole report and the Nile project in general are given on p. 679 of this issue.

Coming now to the report as a whole, it may be stated that of its 126 pages, 10 are devoted to routine matters and 76 to the controversy over charges brought by Sir William Willcocks against the accuracy of certain Nile gage readings. The commission unanimously concluded that these charges were utterly unwarranted. It seems unfortunate that so much of the time and space in its report were given up to them. This is all the more unfortunate in view of the fact that the majority of the commission passes over the vital questions of allocating water and its cost with only three pages of discussion.

Summarizing the Niles Project Commission Report is (1) a whole-hearted and unanimous endorsement of the engineering features of the Nile project, as worked out by the Egyptian Ministry of Public Works, with (2) a majority report made by the British members of the commission that seems to back up the opinion of the Egyptian Government of Public Works as to how the water and its cost should be allocated between the two governments, and (3) a minority report on the same subject by Mr. Cory, the American member, presenting a well-reasoned plan complying with the second and third terms of reference and outlining what he considers to be a just scheme of dividing the water and the cost of its development, taking into account the fundamental world-wide principles that should govern in such a case and also bearing in mind that Egypt and the Sudan should be regarded as wards of Great Britain.

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In the criticism of the Nile project by the committee of Egyptian engineers whose report is listed at the head of this review, it is first alleged that for nearly twenty years "the English officials of the Public Works Ministry" of Egypt "continued to work in secret" on the Nile project. A series of criticisms of the Nile project is then presented, in which some of the basic data are questioned and strenuous objections are made to some parts of the project. A considerable part of this report is reprinted in the Niles Projects Commission Report and discussed by Mr. Cory in his minority report.

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## New Relief Map of the United States

A handsome new relief map of the United States, lithographed in shades of brown and blue in ten printings, has been published by the U. S. Geological Survey (Washington, D. C.; 75c.). The scale is 50 miles to the inch or 1:3,168,000 and the map measures 40 x 70 in. Besides showing relative elevations of land, and also the continental and secondary shelves and the ocean floor (depths of 600, 6,000 and 12,000 ft. or more) the map shows the larger lakes and streams, the principal cities and the state boundaries. The map is the work of John Renshawe who, according to a statement by the Geological Survey, has "made maps, and studied maps and thought maps" ever since he began work for the Survey 41 years ago.

## Special Problems of Flood Control

REVIEWED BY ROBERT E. HORTON

of Horton, Barker & Wheeler, Engineers, Albany, N. Y.

HYDRAULICS OF THE MIAMI FLOOD CONTROL PROJECT—By Sherman M. Woodward, M. Am. Soc. C. E.; M. Am. Soc. M. E.; Consulting Engineer of the Miami Conservancy District; Professor of Mechanics and Hydraulics, State University of Iowa. Technical Reports, Part VII, The Miami Conservancy District. Dayton, Ohio: The District. Paper; 6 x 9 in.; pp. 343; illustrated. $1.

After a description of the great flood of March, 1913, sufficient to form a foundation for what follows, this book takes up hydraulic problems of a special or unusual character which were involved in the design of the Miami flood control works.

Most of the matter treated in the book is outside the ordinary line of categorical discussions in textbooks of hydraulics. Much of the text relates to the determination of requisite capacities of the retarding basins, and the modes of operation of these basins under hypothetical storm conditions. As a foundation for these studies many other problems required solution—such as the determination of the outflow through the discharge conduits of the retarding basins at various water levels, and with conduits flowing full. The effect of the reservoirs operating in conjunction with various floods is considered, but especially a flood resembling that of 1913, but of 20 per cent greater volume.

In addition to the treatment of the operation of reservoirs in such a flood there are studies showing the effect of short, sharp storms of more local character on the individual reservoirs and on the system as a whole. Engineers are generally quite familiar with methods of determining the regulating effect of a single reservoir in conjunction with a given actual or assumed flood graph. In this work it became necessary not only to determine the effect on each retarding basin or reservoir separately but also the effect where all or several of the retarding basins are operating in conjunction. This problem, while somewhat intricate, is treated in a general manner. As a basis for these studies only the discharge in the 1913 flood at Dayton was actually known. Methods of estimating the discharges from the various tributary areas, as under simultaneous flood conditions, are described.

It is not to be expected that all of the special methods developed or used and described in this work will be generally accepted as final. As explained in the text, some of the methods were necessarily arrived at early in the studies, before complete information was at hand, in order to form a basis for a general plan and to outline the reservoir system as a whole. But almost every special topic is treated in such a manner as to throw new light upon it, and there is much in the book that is unquestionably sound and rational and will form a permanent basis for future work along the same line. For example, it is clearly recognized that only floods of definite magnitude can by any possibility occur on a given drainage basin, and the formulas or methods of calculation, indicating that floods of infinite magnitude may ultimately be expected, even if at infinite intervals, cannot form an acceptable basis of economical design.

The discussion of the question as to the probable flood magnitude on a tributary, when the flood graph for the main stream is given, seems, however, somewhat unsatisfactory. It is indicated, although somewhat vaguely, that there are two quite distinct cases: One where the storm is local, thus producing a maximum flood on the tributary, and the flood peak discharge rate per unit of area decreasing in general as the tributary area increases; the other, the case of a general storm, such as that which produced the great flood of 1913, wherein the discharge rates per unit of area, other things being equal, for areas of different sizes may be much the same.

The effects of channel improvement with retarding basins as a means of flood regulation receive attention, and some unusual features of stream channel hydraulics are treated, including the head losses due to channel curvature and varying form of cross-section. Obstruction by bridge piers receives general treatment only, without mathematical discussion.

Finally, the important problem of balancing the flood protection system is taken up in an illuminating manner, with ample illustrations, and the economics of retarding basins as affected by the relation of spillway height and form to the utilization of lands within the basins is given consideration.

The book is written in a lucid and painstaking manner, and contains no more mathematical discussion than is essential to the comprehensive treatment of the problems involved. It is a work on certain advanced features of hydraulics in relation to the hydrology of floods which will be useful not only to those engaged in similar projects but to others interested in various aspects of river channel improvement. It contains a number of tables, including one of four pages, giving essential facts regarding existing flood control reservoirs, and is accompanied by an excellent index.

## A New and Better Work on Public Health

PUBLIC HEALTH AND HYGIENE: In Contributions by Eminent Authorities—Edited by William Hallock Park, M. D., Professor of Bacteriology and Hygiene, University and Bellevue Hospital Medical College, and Director of the Bureau of Laboratories of the Department of Health, New York City. New York and Philadelphia: Lea & Febiger. Cloth; 6 x 9 in.; pp. 881; illustrated with 123 engravings. $10.

Twenty-three men and one woman believing "that there was need for a volume in which the most important phases of hygiene in relation to public health" should "be presented in a practical way by specialists actually devoting themselves to the subjects (here) treated by them" have united in the production of this volume, under the able leadership of Dr. Park. Although the book is represented as being for "public health officials, physicians and medical students" the larger part of its contents would be equally informing and helpful to the increasing number of engineers who, while not public health officials, find it worth their while to keep informed of the advances in public health.

Dr. Park opens the volume with chapters on microorganisms and disease, antimicrobal substances (Dr. Charles Krumwiede, joint author), prevention of infectious diseases, and disinfectants. Further on Dr. Park has chapters on bacterial and other contaminations and infections of milk, meat and other foods. Among other authors and topics are: Dr. George A. Soper, epidemiology; air, health and ventilation, Prof. C.-E. A. Winslow; housing, Lawrence Veillier; the soil and also plumbing, Dr. A. R. Guerard; water supplies and sewage, James T. B. Bowles; sanitation of swimming pools, Dr. W. A. Manheimer; vital statistics, Drs. W. H. Guilfoy and S. W. Wynne.

The book is singularly free from the lapses common to attempts to cover the whole field of public health when made by one man or a few men who cannot possibly have personal knowledge of the subjects treated.

## Factory Administration Revised

REVIEWED BY R. R. POTTER
Mechanical Engineer, Kalamazoo, Mich.

FACTORY ADMINISTRATION AND COST ACCOUNTS: A Reference Book of the Principles and Practice of Industrial Administration and Costing for Present Day Requirements. By Edward T. Elbourne of Messrs. Brindley & Elbourne, Consulting Engineers on Factory Organization and Costing Systems. New York and London: Longmans, Green & Co. Cloth; 6 x 9 in.; pp. 817; illustrated. $15.00.

Mr. Elbourne has so thoroughly rearranged the subject matter in this new edition of his book that it is difficult to draw a close comparison in detail with the earlier edition, which was reviewed in *Engineering News*, Dec. 24, 1914. Three chief reasons are given by the author for so thorough a revision: (1) Costing, or factory cost accounting, had come to be a recognized necessity if competition must be met; (2) efficiency of production, as a result of widespread experience in munitions manufacture, had acquired a new significance; and (3) the relationship of labor, management and capital had undergone a notable alteration. The work still retains its character, however, as primarily a reference book of factory accounting and clerical details.

As it now stands, the book is divided into seven sections: I. General Administration, II. Production control, III. Labor Administration, IV. Material Control, V. Works Accounting—Administrative Records, VI. Cost Accounts, and VII. Specimen Forms. The nature of the rearrangement wil be evident from a comparison with the review of the earlier edition. The general effect is an improved co-ordination and classification of the information presented. The new subject matter is well distributed among the several sections, the net result being an increase of 173 pages. Notable new features include a general diagram of staff organization and functions, a glossary of technical and business terms which may increase the possible usefulness of this book to American readers, and a system of marginal notes throughout the text whereby the reader is referred to other pages bearing on related subjects.

In the preface, the author lays emphasis upon "the fact that the book deals essentially with principles." It would be more definite to say that the book discusses the application to administrative details of principles which, for the most part, remain themselves unstated.

## Design and Construction of Masonry

MASONRY STRUCTURES—By Frederick P. Spalding, Professor of Civil Engineering, University of Missouri. New York: John Wiley & Sons, Inc., London: Chapman & Hall, Ltd. Cloth; 6 x 9 in.; pp. 404; illustrated. $3.50.

As a college text for students just being introduced to structural engineering this book will probably serve. It treats of all of the materials and constructions that possibly could be classed under the head of masonry and discusses them in a quite correct manner. It is not, however, specially valuable beyond the classroom, because, after the fashion of all books on masonry, it groups together a great number of things which have no particular relation to one another and has therefore to treat each one, on account of the lack of space, in a manner much less complete than the particular subject is treated in books devoted especially to it. Subjects covered, for instance, are materials, in which the treatment is adequate and concrete and reinforced-concrete for which obviously a better reference can be found in the numerous special treatises on those subjects; retaining walls, masonry dams, slab and girder bridges, masonry arches, culverts and conduits, and foundations are the remaining headings, and the wide extent of those subjects indicates how broad the field of such a book really must be.

## Work of the War Industries Board

AMERICAN INDUSTRY IN THE WAR: Report of the War Industries Board. By Bernard M. Baruch, Chairman. Washington, D. C.: The Board. Paper; 6 x 9 in.; pp. 421.

Mr. Baruch's report on the activities of the War Industries Board is an essential part of a sane preparedness program. In case of a future emergency we shall want to have, in brief form, just the information here given. The volume presents not merely the historical development of the War Industries Board, but also describes in sufficient detail the activities of its various divisions, so that an excellent idea of what it did can be obtained. Each particular type of work, such as the study of resources, priorities, conservation, price fixing, etc., is first treated in general; then follow brief outlines of the accomplishments of the various commodity sections, which controlled individual products and industries. Appendices give the chief circulars, orders, priority lists, etc., that put into effect the decisions of the board.

Of chief interest is a summary chapter in which Mr. Baruch tries to crystallize the conclusions to be drawn from the work of the board.

One of the most interesting chapters is that on conservation, telling how the waste in industry was cut down during the war.

## Factors in Business Success

AMERICAN BUSINESS METHODS: For Increasing Production and Reducing Costs in Factory, Store and Office—By Floyd W. Parsons, E.M.; Mem.A.I.M.E., M.M.S.A., Academy of Political Science; Founder and Former Editor of *Coal Age*, and Author of Everybody's Business in the *Saturday Evening Post*. New York and London: G. P. Putnam's Sons. Cloth; 6 x 9 in.; pp. 373. $2.50.

Made up largely of articles published in the department entitled "Everybody's Business," in the *Saturday Evening Post*, this book is chiefly inspirational in character. Covering a very wide range of subjects, including labor management, light and ventilation, labor-saving machinery, advertising and selling, and foreign trade, it cannot go into intimate details. It will stimulate the thinking of those who have heretofore given little attention to some of the most fundamental factors in the successful running of industries and business. The book bristles with practical suggestions regarding improvements that make for greater efficiency in the many fields on which it touches.

# PUBLICATIONS RECEIVED

ACCEPTANCES TRADE AND BANKERS'—By Frank Mathewson, Counselor on Business, Finance Management; Vice-President, The Business Bourse, New York; with an Introduction by William Walker Orr, Assistant Secretary, National Association of Credit Men; Former Secretary, American Trade Acceptance Council, etc. New York and London: D. Appleton & Co. Cloth; 5 x 8 in.; pp. 372; illustrated. $3.50.

CALIFORNIA BOARD OF STATE HARBOR COMMISSIONERS: Report, 1918-20. San Francisco, Cal.: The Board. Paper; 6 x 9 in.; pp. 136; illustrated.

THE CARNEGIE FOUNDATION FOR THE ADVANCEMENT OF TEACHING: Report of the President and of the Treasurer. New York: The Foundation. Paper; 7 x 10 in.; pp. 171.

THE CLEVELAND THOROUGHFARE PLAN. Cleveland, Ohio: City Plan Commission. Paper; 8 x 11 in.; pp. 15; illustrated. An article on this plan appeared in *Engineering-News-Record* March 3, 1921, p. 382.

CORN-BELT FARMERS' EXPERIENCE WITH MOTOR TRUCKS: A Study of 831 Reports from Farmers Who Own

Motor Trucks—By H. R. Tolley, Agricultural Engineer, and L. M. Church, Assistant in Farm Accounting. Washington, D. C.: U. S. Dept. of Agriculture. Paper; 6 x 9 in.; pp. 31; illustrated. 10c. from Superintendent of Documents.

THE DYNAMICS OF THE AIRPLANE—By Kenneth P. Williams, Ph.D., Associate Professor of Mathematics, Indiana University. New York: John Wiley & Sons, Inc. London: Chapman & Hall, Ltd. Cloth; 6 x 9 in.; pp. 138; illustrated. $2.50 postpaid.

ELECTRIC-ARC WELDING OF STEEL—I: Properties of the Arc-Fused Metal—By Henry S. Rawdon, Physicist; Edward C. Groesbeck, Physical Chemist; Louis Jordan, Associate Chemist, Bureau of Standards. Washington, D. C.: The Bureau. Paper; 7 x 10 in.; pp. 63; illustrated. 15c. from Superintendent of Documents.

ENGINEERING COUNCIL: A Brief History—By J. Parke Channing, Philip N. Moore, Alfred D. Flinn, Members, Am. Soc. C. E., A.S.M.E., A.I.E.E., etc. New York: The Council, 29 W. 39th St. Paper; 6 x 9 in.; pp. 27.

THE ENGINEERING FOUNDATION OF UNITED ENGINEERING SOCIETY: Report for Year Ended Feb. 10, 1921. New York: The Foundation, Engineering Societies Building. Paper; 7 x 10 in.; pp. 32.

FACTORS GOVERNING THE SELECTION AND PROTECTION OF SOURCES OF WATER SUPPLY—By J. K. Hoskins, Associate Sanitary Engineer, U. S. Public Health Service. Washington, D. C.: The Service. Paper; 6 x 9 in.; pp. 20. 5c. from Superintendent of Documents.

FIFTEEN YEARS FILTRATION PRACTICE IN INDIANAPOLIS—By H. E. Jordan. (From Proceedings of the Thirteenth Annual Convention of the Indiana Sanitary and Water Supply Association.) Indianapolis, Ind.: Indianapolis Water Co. Paper; 6 x 9 in.; pp. 68.

A unique and valuable summary of the various details of water-filter operation at Indianapolis. An abstract of the paper appeared in *Engineering News-Record*, Feb. 3, 1921, p. 218.

FINANCIAL STATISTICS OF CITIES HAVING A POPULATION OF OVER 30,000: Report, 1919. Washington, D. C.: Bureau of Census. Paper; 9 x 12 in.; pp. 355; illustrated.

THE FUNDAMENTAL PRINCIPLES OF WATER POWER ENGINEERING: Describing Types, Applications and Operation of Water Turbines and Developing the Fundamental Formulæ of Water Power Engineering—By Frank F. Fergusson, C.E., Assoc. M.Inst.C.E., Assoc.Mem.Am.Soc.C.E. New York and London: Isaac Pitman & Sons. Cloth; 4 x 6 in.; pp. 116; illustrated. $1.

An admirable little treatise from the English viewpoint. In a few pages the author ranges over the design of the power plant. The book has little to do with the hydraulics of a development prior to the time the water enters the turbines. That the author does not think very well of or know very much about American practice may be inferred from the fact that in the short list of "Periodicals Making a Special Feature of Papers on Water Power, Etc.," there is no reference whatsoever to any American periodical or engineering society.

HYDRO-ELECTRIC DEVELOPMENT IN ONTARIO: A History of Water-Power Administration Under the Hydro-Electric Power Commission of Ontario—By E. B. Biggar, Author of "Canadian Railway Problem," former Editor of *Canadian Engineer*, etc. Toronto, Can.: The Biggar Press, Ltd. Cloth; 5 x 8 in.; pp. 202; illustrated.

An inspired eulogy of the Hydro-Electric Power Commission of Ontario. The controversy in Canada regarding the merits or defects of "Hydro" is violent. No one apparently is unprejudiced or non-partisan in the discussion. Such a book as this one serves little purpose, therefore, in settling the question whether "Hydro" is or is not an economic success.

MASSACHUSETTS STATE DEPARTMENT OF HEALTH: Report. Boston, Mass.: The Department. Cloth; 6 x 9 in.; pp. 220.

MINERAL PRODUCTION OF CANADA: Preliminary Report, 1920—Prepared by John McLeish, B.A., Chief of the Division of Mineral Resources and Statistics. Ottawa, Can.: Dept. of Mines. Paper; 7 x 10 in.; pp. 24.

MISSISSIPPI RIVER COMMISSION: (Extracts from the Annual Report of the Chief of Engineers to the Secretary of War.) Washington, D. C.: War Dept. Paper; 6 x 9 in.; pp. 1307; illustrated.

MODERN ROAD BUILDING AND MAINTENANCE: Principles and Practice; Prepared for the Use of Engineers, Contractors, Road Officials, Students and All Who Are Interested in the Rational and Economic Solution of the Many Problems Connected with Our Public Roads and the Traffic They Are Required to Carry—By Andrew P. Anderson, Highway Engineer, Bureau of Public Roads, U. S. Dept. of Agriculture. Chicago and New York: Hercules Powder Co. Paper; 6 x 9 in.; pp. 116; illustrated.

About 120 pages on road planning, materials, construction, maintenance and 25 pages on the use of explosives in road work.

MOTOR TRACTION AND ROAD RAILWAYS: Including the Stronach-Dutton-System—By Sir F. D. Couchman, K.B.E., M.Inst.C.E., and Major-General Sir H. F. E. Freeland, K.C.I.E., C.B., M.V.O., D.S.O., R.E.; with an Introductory Note by F. G. Royal-Dawson, M.Inst.C.E., Chief Engineer with the Railway Board. Simla, India: Railway Board. Paper; 8 x 13 in.; pp. 41; illustrated. 1 Rupee.

THE MYSORE ENGINEERS' ASSOCIATION, BANGALORE: Proceedings, 1920. Bangalore, India: The Association. Paper; 5 x 8 in.; pp. 193; illustrated.

NEW HAMPSHIRE STATE HIGHWAY DEPARTMENT: Report Relative to Highway Improvement. Concord, N. H.: The Department. Cloth; 6 x 9 in.; pp. 243; illustrated.

NEW YORK DEPARTMENT OF LABOR: Special Bulletin Issued Under the Direction of the Industrial Commission, Including N. Y. Court Decisions on Labor Law and Industrial Disputes, January, 1915-21. Albany, N. Y.: Bureau of Statistics and Information. Paper; 6 x 9 in.; pp. 200.

NEW YORK STATE INCOME TAX PROCEDURE, 1921: Including Corporation Franchise Tax—By Robert H. Montgomery, C.P.A. of Lybrand, Ross Brothers and Montgomery; Attorney-at-Law; Former President, American Association of Public Accountants; Professor of Accounting, Columbia University. New York: The Ronald Press Co. Cloth; 6 x 9 in.; pp. 682.

PENNSYLVANIA MINING STATUTES ANNOTATED—By J. W. Thompson. Washington, D. C.: Bureau of Mines. Paper; 6 x 9 in.; pp. 1221; $1 from Superintendent of Documents.

THE PEOPLE'S BUSINESS IN THE FIFTH CITY: Facts About the Affairs and Activities of the City of Cleveland—W. S. FitzGerald, Mayor; a Plain Statement of the Manner in Which the People's Business Was Managed and Their Money Spent During 1920—Compiled and Edited by M. E. Bourjaily, Commissioner, Bureau of Information and Research. Cleveland, Ohio: The Bureau. Paper; 8 x 11 in.; pp. 48; illustrated.

Instead of printing 500 copies of a 2,000-page volume of little interest or value to anyone, as formerly, 100,000 copies of an 48-page readable pamphlet outlining various city activities were printed and distributed from house to house. The new plan is commendable but can hardly be accepted as a substitute for department reports, which, properly written, are well worth while.

THE POWER SITUATION DURING THE WAR—By Col. Charles Keller, Corps of Engineers; with Appendixes Containing Reports on Conditions in the Several Power Districts. Washington, D. C.: War Dept. Paper; 6 x 9 in.; pp. 300; illustrated.

PROGRESS REPORT OF THE NATIONAL SCREW THREAD COMMISSION. Washington, D. C.: Bureau of Standards. Paper; 7 x 10 in.; pp. 109; illustrated. Free on Application.

Contains standards for screw threads, established by the Commission according to law.

THE PRICE OF LUMBER: A Study of the Fundamental Conditions in the Lumber Industry—By Robert B. Goodman, Secretary of the Goodman Lumber Co. and Chairman of the Committee on Economics of the National Lumber Manufacturers' Association; An Address Delivered at Yale University, January, 1921, under the Auspices of the School of Forestry on the 20th Engineers' Memorial Foundation. Chicago, Ill.: The National Lumber Manufacturers' Association. Paper; 5 x 8 in.; pp. 29; illustrated.

The lecture is supplemented by a Bibliography of 2 pages and statistics and diagrams showing the yearly index numbers of (1) wholesale prices for all commodities and (2) of lumber building material for the years 1850, 1855 and then yearly to 1920, together with the percentages of (2) to (1).

RED-LEAD AND HOW TO USE IT IN PAINT—By Alvah Horton Sabin, M.S., D.Sc., Author of "Technology of Paint and Varnish," "White-Lead," etc.; Member of the American Chemical Society, the Society of Chemical Industry, etc. Third Edition, Rewritten and Enlarged. New York: John Wiley & Sons, Inc. London: Chapman & Hall, Ltd. Cloth; 5 x 7 in.; pp. 139; illustrated. $2 postpaid.

REGULATION OF EXPLOSIVES IN THE UNITED STATES: With Especial Reference to the Administration of the Explosives Act of October, 1917, by the Bureau of Mines—By Charles E. Munroe. Washington, D. C.: Bureau of Mines. Paper; 6 x 9 in.; pp. 45. 10c. from Superintendent of Documents.

SHADES AND SHADOWS—By David C. Lange, M.S., Instructor in Architecture in the Washington State College. New York: John Wiley & Sons, Inc. London: Chapman & Hall, Ltd. Cloth; 6 x 9 in.; pp. 135; illustrated. $2.50 postpaid; 15/ net.

A text for architectural students. The book first takes up the elements of descriptive geometry. It then goes on with the subject from the architectural viewpoint.

STANDARD METHODS FOR THE EXAMINATION OF WATER AND SEWAGE: Fourth Edition Revised by Committees of the American Public Health Association, American Chemical Society, and Referees of the Association of Official Agricultural Chemists. Boston, Mass.: American Public Health Association. Paper; 7 x 10 in.; pp. 115; illustrated. Paper, 60c.; Cloth, $1.25.

Embodies changes (in bacterial methods only) recommended by the Committee in its 1919 report and adopted by the Laboratory section. Some of the more important changes are: Authorization of new brands of peptone; phenol red method of hydrogen-ion concentration; and preforation of endo medium.

STATE WATER COMMISSION OF CALIFORNIA: Report, 1919-20. San Francisco, Cal.: The Commission. Paper; 6 x 9 in.; pp. 176; illustrated.

STATISTICS OF COMMON CARRIERS: Preliminary Abstract, 1919. Washington, D. C.: Bureau of Statistics. Paper; 9 x 12 in.; pp. 172.

STRUCTURAL DEFECTS INFLUENCING THE SPREAD OF FIRE: Suggestions for Their Elimination and Protection—Prepared by the Committee on Manufacturing Risks and Special Hazards. Boston, Mass.: National Fire Protection Association. Paper; 6 x 9 in.; pp. 18; illustrated. 10c.

TRAIN RESISTANCES: For Various Gauges, Rail Sections, Track Conditions and Types of Rolling Stock—By F. G. Royal-Dawson, M.Inst.C.E., Chief Engineer with the Railway Board. Simla, India: The Board. Paper; 8 x 13 in.; pp. 31. 4 As.

THE USE OF CONCRETE PIPE IN IRRIGATION—By F. W. Stanley, Senior Irrigation Engineer, with Introductory Paragraphs by Samuel Portier, Chief of Irrigation Division, U. S. Department of Agriculture. Washington, D. C.: The Dept. Paper; 6 x 9 in.; pp. 54; illustrated. 20c. from Superintendent of Documents.

Includes various accessories, such as settling basins and screens, air vents, relief stands, measuring devices and distributing hydrants. Gives cost figures. Contains tables of pipe capacities and weir discharges.

# LETTERS TO THE EDITOR

***If you have ideas that would interest engineers and contractors we shall be glad to give them space here. We urge, however, that you be brief so that a wide range of subjects may be covered in the available space.—The Editor.***

## When Would the New Am. Soc. C. E. Constitution Begin to Function?

Sir—Several questions have been raised regarding the working of the machinery of the proposed new constitution of the American Society of Civil Engineers providing it is adopted in its present or amended form, and the answers to some of these questions are contained in the accompanying copy of letter from Parker and Aaron, Attorneys for the Society and also for the Committee on Referred Amendments: P. H. NORCROSS,

Atlanta, Ga., April 11. Committee on Referred Amendments.

Dear Mr. Norcross: We beg to acknowledge receipt of your letter asking our opinion as to the effective date of the new revised constitution in event that it shall be approved by the vote of the members. The time at which the new constitution can take effect is limited and prescribed by the terms of the present constitution, which prescribes that amendments shall be voted upon by letter ballot in the form as amended by the business meeting during the annual convention, or if not so amended they shall be voted upon by letter ballot as submitted, the vote to be counted at the first regular meeting in October. The present constitution further provides that amendments so adopted shall take effect thirty days after their adoption.

The revised constitution therefore, if approved, will necessarily take effect and be in force thirty after the first regular meeting in October next and will be in foce from that time until thereafter amended.

About this there can be no doubt. The real question would seem to arise as to what effect the adoption of this new constitution will have upon the proceedings at the annual meeting held on the third Wednesday in January. The nominations for officers to be elected at that meeting will not be made under the provisions of the new constitution. On the other hand, the nominating committee provided for under the present constitution will have completed its duties and submitted its candidates prior to the taking effect of the revised constitution. There will be in December, 1921, no legal provision requiring the submission of the names thus selected by the nominating committee to the corporate members prior to the annual meeting, but nominations by declaration in accordance with the provisions of the revised constitution will be in order. It may be assumed that the Board of Direction will authorize or require the Secretary to send out the nominations as made by the nominating committee to the corporate members in the manner prescribed by the present constitution, but there will be no compulsion on the Board to do so. If it be deemed necessary to insert a transitory article in the revised draft providing that in December, 1921, the Secretary shall send out the names prepared by the nominating committee in the manner provided in the present constitution, such a transitory clause may be added to the proposed draft. We think, however, that the constitution could properly be met by the action of the Board of Direction requiring this matter of submission of these names as a matter of information to the electorate. In all other respects the revised consitution will inevitably take effect as of thiry days from date of adoption.

Of course the adoption of the revised constitution will not affect the tenure of office of any of the present Board of Direction, including among them the present five past presidents, who will continue to serve until they cease to be the five latest past president or resign their office as directors. This circumstance is due to that provision of the New York statute that prevents an amendment legislating directors out of their office.

(Signed) PARKER & AARON.

## Disparities in Highway Bids

Sir—I notice, among your editorials of the March 31 issue, an article entitled "Disparities in Highway Bids." As I read it, the author seriously questions the prices being paid for Pennsylvania highways as compared to other states, and wishes facts on the subject.

As an engineer of long practice and experience in highway construction, I could give you a careful analysis of the whys and wherefores of this "seeming disparity," but prefer to give you the comparison as set forth by one of the most reputable highway contractors of New York, who has contracted not only in New York and Pennsylvania, but elsewhere. His statement is as follows:

As compared to New York, the steel reinforcement required in Pennsylvania is more than double in weight (making a difference in cost of nearly $2,000 per mile of concrete roadway 18 ft. wide). The excavation is unclassified, making the item a pure gamble. Pennsylvania in general is very mountainous, with steep grades and long hauls. Contractors are not paid for sod removal by direct item, and this also introduces another risk. Last, but not least, the very rigid and strict inspection in Pennsylvania places the work upon an entirely different basis, and the price per mile therefore, cannot be compared with other states with so widely different conditions.

On a fair basis of comparison, more money can be made with quoted prices in other states than with present prices in Pennsylvania. If those who are making statements about the prices being paid for Pennsylvania work, without any knowledge of the true conditions, can perform in the field the wonders they set forth on paper, they can pick their job and set their own salary as a "Highway Construction Doctor."

Another contractor of national reputation, who has built highways in many of the Eastern States, calls attention to the following:

Acceptable sources of stone and sand supply, particularly for reinforced concrete pavement, are not so numerous in Pennsylvania as in the state of New York, thereby making the average freight rate on concrete aggregates higher; also the average price for crushed stone, as charged by the producing quarries in Pennsylvania, is higher than that in New York. Another point on which it is difficult to fix an exact money difference, is that of interpretation of the requirements on materials. This frequently changes the entire aspect of a contract. In Pennsylvania the interpretation is considerably more rigid than that of New York or Ohio.

In closing this note I would simply add that frequently, in Pennsylvania highway contracts, the grading costs are between 20 and 30 per cent of the entire contract, whereas in other states it is as low as 5 per cent. In addition to this, many of the points so well put by William B. King, of the Bar of Court of Claims, Washington, D. C., in his article in *Engineering News-Record*, Feb. 3, 1921, p. 227, entitled "Minimizing the Risk," find application in Pennsylvania, and until these risks are eliminated, the conservative, responsible contractor must bid accordingly.

At this point, however, it is only fair and just to the Pennsylvania State Highway Department, to say that Pennsylvania is getting the highest class and most durable type of road construction of any state in the Union, and when all other factors have been given due consideration, this one stands out pre-eminently. Low first costs satisfy for the moment, but they are soon forgotten, while fair, ultimate economic costs are facts which live with the roads.

Harrisburg, Pa., April 11 CHAS. F. PUFF, JR.,
Secretary and General Manager
Associated Pennsylvania Highway Contractors.

## Corner Breakage of Concrete Road Slabs

Sir—In *Engineering News-Record*, Feb. 3, 1921, p. 210, Clifford Older calls attention to the breaking down of the corners of concrete slabs. In Mr. Older's opinion it is necessary to reinforce slabs at the corners, or else make them sufficiently thick to withstand the loads imposed.

The information regarding the saturation of subgrade is most interesting and coincides with the experience of the writer. Throughout California, on practically every highway built in the State, on ground which is effected by moisture, there has been a great deal of breaking of corner slabs. Such reinforcement as has been tried, has not materially corrected this evil and I believe it cannot be corrected by reinforcement, unless a very thorough job is done.

A point which seems to have been overlooked by practically all designers of concrete slabs is the fact shown by Mr. Older, though not brought out in sufficient detail, that the cause of the breaking of the corners is that the supported area under a corner is a triangular segment of concrete having an area equal to one-half that of any other bearing section of pavement.

A number of years ago the writer devised a joint support for concrete pavements. A strip of base 4 in. thick and 18 in. wide was first constructed, with its surface even with the surface of the subgrade, and the concrete pavement was then constructed with a joint over the center of this supporting strip. The result was that whereas earlier pavements had broken or cracked at the joints, this breakage did not occur on subsequent concrete pavements. There are numerous streets and alleys in Los Angeles built in this way and they are all giving first-class service, with no signs of failure at the joints. I believe it would be entirely feasible to construct two parallel supporting

strips along the edges of the highway, so that the outer edge of the pavement proper should have an adequate foundation to support the load imposed upon it. Inasmuch as points of cracking in concrete pavements cannot be readily predicted, it seems inadvisable to place supports across a highway, but it may be that this also would be advisable under certain conditions. The fact that even the heaviest highways crack at the corners, indicates that something besides reinforcement is necessary and I believe the solution lies in the well-worn principle of requiring equal areas to be provided for equal pressures, a condition which does not usually exist in highway design.

San Francisco, Cal., Feb. 28. C. S. POPE.

[A copy of the preceding letter was sent to Mr. Older. His reply follows—EDITOR.]

Sir—Mr. Pope's observations of the breaking down of corners of pavement slabs and his suggested remedy are of much interest.

*Engineering News-Record*, March 24, 1921, p. 504, contains a brief description of the plan proposed by the Illinois Department of Public Works and Buildings to strengthen the corners of pavement slabs. Briefly, the ¾-in. bar, called for along the edge of the pavement, should be means of its shear value cause an equal deflection and thereby equal stresses in the corners formed by transverse cracks or joints. The bar is proportioned to transfer one-half of a four-ton load (the maximum wheel load permitted under the Illinois law) across the crack or joint, thus reducing the transverse bending stress in each corner to one-half of the amount that would otherwise occur.

At the cracks this bar will be subjected to shearing, bending and direct tensile stresses and the concrete to bearing and tensile stresses.

In the bar, the total shearing stress may safely be assumed as equal to one-half the maximum wheel load. At the crack each wheel load causing a deflection of the corners will undoubtedly bend the bar through a slight angle. A four-ton wheel load on a 7-in. slab, deflects the corners from two to three hundredths of an inch. The bar therefore must bend, with the passage of each wheel load, through an angle equal to that formed by lines tangent to the deflection curves of the slabs at the crack. The ultimate effect of this bending remains to be determined.

At the cracks the bar will be subjected to a more or less concentrated direct tensile stress due to the contraction of the slabs. The bars are to be coated with paint and asphalt to reduce the bond and thus facilitate slipping adjacent to the crack. It is hoped that the slip will extend for a sufficient length of the bar to prevent rupture due to direct tension.

The concrete adjacent to the crack and under and over the bar on opposite sides will be called upon to sustain a total bearing stress equal to one-half of the wheel load. This stress will be greatest immediately adjacent to the crack. A slight failure of the concrete adjacent to the crack in bearing would cause a readjustment of the bearing stresses, the tendency being to reduce the maximum. The ultimate result remains to be determined. Tensile stresses will occur in the concrete immediately above and below the bar on opposite sides of the crack. A consideration of the probable area of concrete effective to resist this tension would indicate there should be no serious danger of the bar "stripping out" adjacent to the crack.

It would of course be possible to reduce the bearing and tensile stresses in the concrete due to the presence of the bar at the joint by using additional bars.

The possibility of rupture due to the concentration of contraction at certain joints might be reduced by using frequent transverse dividing planes in the slab.

It is obvious that the adoption of some means whereby both corners may be made to act together in supporting the traffic loads is much to be desired.

It is appreciated that the method proposed may not be the ultimate solution. CLIFFORD OLDER,

Springfield, Ill., April 5. Chief Highway Engineer.

## Useful Dodges in Surveying

Sir—Under the caption "Useful Dodges in Surveying" in your issue of April 14, p. 653, you publish letters of Mr. Whitmore and Mr. Roberts, who discussed a previous letter of Mr. Thackwell. In the annual reports of the Philadelphia Water Department of 1883 and 1884 you will find a description, with practical details, of a method fully as simple and economical, according to which about 450 sq. miles of territory in eastern Pennsylvania were surveyed in the interest of new water supply for Philadelphia. It was quite similar to the method described by Mr. Whitmore. The surveys were plotted on the ground to a scale of 400 ft. to the inch, and subsequently traced upon large maps which are still at the Philadelphia department. These maps were accepted by the U. S. Geological Survey, and published by it in their usual scale of 1 mile to the inch, as a part of their survey of the state.

After a general triangulation had been made over the territory, with a fixed point established on about every square mile, the topographical survey was made by several parties, each one consisting of a topographer, leveler and rodman. The instruments were a transit, a so-called field table with alidade and a level rod. The field table (a baby plane table or *croquis*) modeled after Swiss practice, was about 15 in. square and rested on a very light tripod. The work on it began by the plotting of one of the established triangulation points upon the table, after orientation. The alidade, almost as simple as a triangular scale, with vertical sight hairs at each end, was used to sight in all desired points, including the rod held by the rodman, and to mark straight lines leading to them. The distances to the rod locations were obtained by stadia readings with the transit. The elevations were obtained from angles read on the vertical arc of the transit. These were computed and plotted, as were all the topography, roads, buildings, forest borders, main fence lines, etc., and all the contour lines were sketched in with full view of the field before the field table was moved to another point. The scale of the plot was 400 ft. to the inch. The contour lines were subsequently adjusted to 5 or 10-ft. intervals, before the sheets were transferred to the large maps now at the office.

Four different pencils were used: A black one, I believe, for the roads and buildings, a brown one for the contours, a green one for the forests and a blue one for the water courses. Kenneth Allen, now sanitary engineer of the Board of Estimate and Appointment in New York, led one of the parties.

The areas thus surveyed and plotted on the field sheets were turned in weekly, and each party covered from 2 to 3½ sq. miles of territory. This survey, therefore, was similar to the Lucas County survey, described by Mr. Whitmore. The cost of our entire field work, including the plotting as described, was, I believe, less than 5 cents per acre, and was the first survey of the kind. The details were mostly worked out by us in the office during the winter of 1883 and 1884. Some improvements were subsequently made in the field.

In view of the limited appropriation for the survey, originally not intended to be as extensive as we make it, it had become necessary to evolve a sufficiently accurate method that could be employed at a very small cost. Col. Wm. Ludlow, U. S. A., was then chief engineer of the Water Department. RUDOLPH HERING,

New York City, April 18. Consulting Engineer.

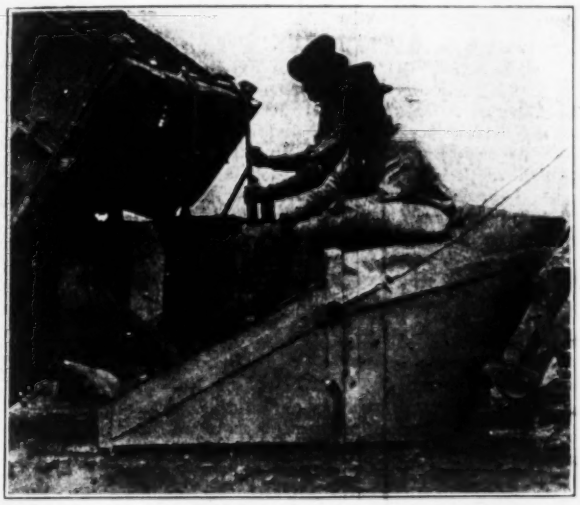
## Fusing Temperatures of Concrete Measured

Determinations of the fusing point of concrete have been made at the Bureau of Standards on small specimens. They give the fusing temperature as about 1,200 deg. C., which is approximately 2,200 deg. F. The temperature probably varies with the kind of sand and cement used. Fusion of concrete has been observed in one or two very hot fires in reinforced-concrete manufacturing buildings, and was also noticed as occurring frequently in the fire tests of columns recently completed at the Underwriters' Laboratories.

# HINTS FOR THE CONTRACTOR

## Tail-Gate Measuring Box Minimizes Handling of Road Materials

IN repairing California pavements, where a series of concrete patches are to be put in, and where the work is extensive enough to warrant using a concrete mixer, a device is used by means of which materials are delivered, batch by batch, direct from motor truck to the mixer hopper. Advantages claimed for this device are that (1) it avoids the necessity for piling material along the right-of-way ahead of the mixer; (2) it reduces the material-handling crew by four men; and (3) it delivers cleaner material to the mixer.



TAIL-GATE MEASURING BOX DISCHARGING AGGREGATE INTO MIXER SKIP

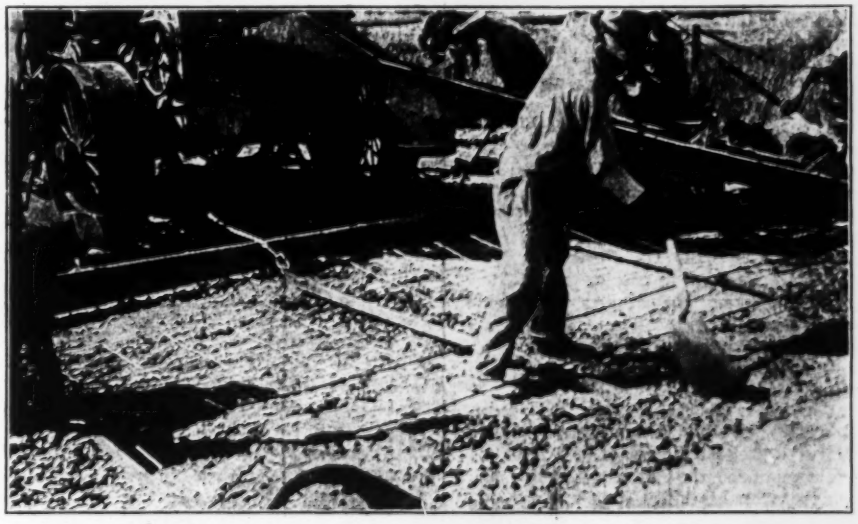
The device consists of a measuring box made of 2-in. plank which is hung under the tail-gate of a tilting-body truck by ½ x 2-in. iron straps. The iron straps have their upper ends turned over in hook form and these hooks are slipped over the rod across the top of the tail-gate. Only one box is required on the job, as it is removed from an empty truck and put on the loaded truck that takes its place. The box is divided by a vertical partition into two compartments, one for sand and one for rock. The trucks to be used with it are likewise provided with a longitudinal partition which divides the truck body into sand and rock compartments in the capacity ratio of one to two. In the tail-gate, on each side of this partition, is a small shear gate, and one compartment of the measuring box is always under each of these small gates. When the truck is full the box can be filled without tilting the truck body; as the materials are used up, the truck body is tilted to the angle necessary to continue to deliver the materials by gravity.

The measuring box holds 4 cu.ft. of rock and 2 cu.ft. of sand, which, with one sack of cement just makes a batch for the mixer ordinarily used on patching work. The bottom of the box slopes away from the truck toward the side which is hinged so that, by tripping a latch at the bottom, the contents of both compartments are quickly discharged. With the mixer hopper on the ground ready for a charge, the truck moves back until the measuring box is over it, and the contents of the box are discharged directly into it. Just enough cement is brought with each load so no cement storage is necessary along the road.

## Mixer on Paving Jobs Drags Pipes that Support Reinforcing

A convenient means of supporting reinforcing bars in concrete pavement, adopted by the California Highway Commission, is shown in the accompanying illustration. The bars are laid on pipes which are attached by means of chains to the concrete mixer and are dragged forward before the concrete sets, each time the mixer moves to new position.

The method first used, that of pulling the bars up into place by means of hooks after pouring the slab, was slow and costly, and the final position of the bars in the concrete was uncertain. The present method uses two pieces of 2-in. galvanized iron pipe, 4 to 8 ft. in length, according to the length of roadway poured at each position of the mixer. One of the pipes is placed at each one-third point on the roadway width. The ends of the pipes are flattened and punched so that they can be conveniently attached to the mixer by chains.



PIPE SUPPORTS FOR BARS ATTACHED TO MIXER

# NEWS OF THE WEEK

New York, April 21, 1921

## State Officials Confer on Highway Policies

### Delegation Drafts Bill Confining Federal-Aid to Two Classes of Roads and Calls on President

*(Washington Correspondence)*

State highway officials met in Washington last week and drafted a bill providing new conditions under which federal aid is to be extended to the states for the construction of public roads. The bill was submitted to the Secretary of Agriculture for his approval. As changes in the text are likely to be made, the proposed bill was not made public. It is understood, however, that it provides for road classification, for complusory maintenance on the part of the states and for the contribution by the states, as states, of the co-operative funds. The bill is understood to confine federal aid to a small percentage of the total road mileage of the state with the federal aid confined to Class 1 and Class 2 roads, with the states contributing a larger percentage of the cost in the case of Class 2 roads.

It was admitted by state highway officials that the bill, as drafted, is the most stringent in its provisions that ever had been contemplated by the states, but that the highway department representatives of all the states are practically pledged to a bill of the type drafted. The measure was described as "a golden mean between inadvisable extremes." It was made very clear that the highway officials are to take no stand as to the type of agency which will administer the federal-aid fund for the government. It was stated authoritatively that it had been decided to take no part whatever in the controversy as to whether road matters should be administered by the U. S. Bureau of Public Roads or by a new independent agency.

The State highway officials were received by President Harding on April 14. They assured the President that they are highly appreciative of the attention given the highway problem in his recent message to Congress. They told him that they are thoroughly in accord with everything he said. (See p. 687 of this issue.)

Senator Townsend of Michigan, chairman of the Committee on Post Offices and Post Roads of the Senate, has announced that hearings will soon be begun on his bill. It is understood that Senator Townsend has given up the idea of building roads with federal money alone. The state highway commissioners have not decided whether they will appear at the Townsend hearing or whether they will confine their attention entirely to the bill which will be introduced on their behalf in the House of Representatives. It was stated by state highway officials that they have not approved any one of the various road bills which have been introduced at the extra session.

There is considerable difference of opinion among highway officials as to just what the President intended to convey when he said in his message that "the federal agency of administration should be elevated to the importance and vested with authority comparable to the work before it." Some think that this means that the Secretary of Agriculture should be given broader powers, some are of the opinion that the President had in mind the creation of a Department of Public Works, to which the Bureau of Roads would be transferred, while some admitted that it looks like an endorsement of a federal highway commission.

W. C. Markham, legislative representative of the American Association of State Highway Officials declined early this week to divulge any detailed information as to the provision of the federal-aid bill which the state highway officials have drafted. The draft is in the hands of the solicitors of the department of Agriculture. It will go to the Secretary of Agriculture and later in the week to the President. It is possible that some of the suggestions of the Secretary of Agriculture will be embodied in the draft of the bill. The draft of the bill will not be made public until the President has had an opportunity to study it.

## Hoover Resigns as President of Engineering Council

At the meeting of the executive board of American Engineering Council in Philadelphia, April 16, noted elsewhere in these columns, Herbert Hoover tendered his resignation as president of American Engineering Council. He did this because he considered that the activities of the council and of the Federated American Engineering Societies in national affairs would be likely to place him in an embarrassing position on account of his Cabinet post. He indicated that his interest in the work of the council and of the federation had in no degree diminished. In fact, he reiterated that he believed the formation of the Federated American Engineering Societies was the starting point of one of the most valuable voluntary services that could be rendered the nation.

His successor as president of the council was not elected at the meeting, but the selection of a successor was referred to the consideration of the council's committee on procedure.

## Urge Governor To Oppose Corporation Engineering

### Col. Wilgus Heads Group of Engineers in Petition for Hearing on License Bill

Headed by Col. William J. Wilgus, consulting engineer, New York City, 49 engineers have addressed to Governor Miller, of New York, a communication asking for a hearing on the bill to amend the existing professional engineers' license law which has already passed the State Assembly and the Senate and is before the Governor for final action. The petition calls upon the Governor to veto the bill known as Senate Bill 147,716, which would permit the practice of engineering by corporations. The engineering profession, in the event of the Governor's veto, will then, it is stated, have before it an unprejudged, clean-cut issue on which to go to its membership with a view to offering suitable amendments at the next session of the Legislature.

The petition opposes the definition of professional engineering contained in Senate Bill 147,716 and finds seven other grounds for objection to the measure which, it is asserted, would: Nullify the intent of the law; divide allegiance; cause the loss of professional responsibility; violate the code of ethics; place New York engineers on a plane lower than in other states; lower the dignity of the profession; be detrimental to the public interest.

In conclusion the petitioning engineers make the following request: "May we ask that you kindly give us a hearing at such time as you may fix so that, first-handed, you may see who we are, and so that we may orally supplement what we have here said with such additional data or arguments as may be required for the clarification of a matter that means so much to our profession and to the public."

Copies of the petition have been sent to the headquarters and to the local sections of the national societies of civil, mechanical, electrical, mining and chemical engineering.

## Indiana Engineers Oppose License Law Changes

A resolution opposing any changes in the existing New York State license law for engineers was approved April 13 at a meeting of the Indianapolis Chapter of the American Association of Engineers. The Indianapolis engineers operate under a law which recognizes the practice of engineering by corporations. It is claimed that in proposed amendments to the New York law the reciprocity section is so worded as to discriminate against Indiana engineers.

## Federation's Board Plans Engineering Assembly

**Philadelphia Meeting Considers Questions of Public Affairs—Committee to Report on New York Licensing**

The executive board of American Engineering Council held its regular bi-monthly meeting in Philadelphia, April 16. Aside from the resignation of Herbert Hoover as president of the council, noted elsewhere in these columns, the outstanding feature was the decision to hold an "Engineering Assembly" in Washington in January, 1922. The remaining time of the sessions was devoted to the consideration of reports of committees and the reference to these committees of new matters brought to the consideration of the board.

The Engineering Assembly is to be a two-day session for the discussion of engineering problems. A committee was appointed to make arrangements for holding it.

Considerable time was given to a discussion of the employment bureau, resulting in a decision to appoint a committee of three to study the whole problem and report back to the board. The Duluth Engineering Society, the Boston Society of Civil Engineers, and the Milwaukee Engineering Society were admitted to membership. The next meeting was fixed for June 3, and, according to previous decision, will be held in St. Louis. W. W. Varney, who has been serving as acting treasurer, was elected treasurer.

The secretary reported that the work of the committee on elimination of waste in industry had proceeded according to schedule, that brief summary reports would be available for newspapers in June, and for longer magazine articles in July and August.

PUBLIC AFFAIRS

The committee on public affairs deemed it inadvisable for the council to engage in activities with reference to the general reorganization of the government. It believes that the council will be stronger if it confines its efforts to presenting to Congress and the public the merits of the proposal to establish a Department of Public Works. Plans are maturing for presentation of the latter subject to the congressional committee which is studying the reorganization of the national government. The council's representative on the Board for Jurisdictional Awards in the Building Industry, Rudolph P. Miller, reported on the work of that body. The executive board approved the continuance of the council's participation in the work and reappointed Mr. Miller as the council's representative.

Proposals that the council consider the New York water-power situation, better recognition of the officers of the Public Health Service, national legislation regarding standards, the quantity survey method, and a new bill for appropriations for completing the topographic map of the United States were referred to the appropriate committees for consideration and report.

A statement was made regarding the controversy in New York State with reference to the exclusion of corporations and unrestricted partnerships from the practice of engineering, and the matter was referred to the council's original committee on licensing.

The meetings were held at the Philadelphia Engineers' Club and the members of the executive board were the club's guests at luncheon.

## Philadelphia Engineers Give Dinner to Hoover

Herbert Hoover was the guest of honor at a dinner in Philadelphia, April 16, given by the engineers of that district, under the auspices of the Philadelphia Engineers' Club and its affiliated societies. Over 600 were present. The function was a brilliant affair and afforded opportunity for Mr. Hoover to discuss the need for governmental reorganization and to indicate the functions that he believed should be exercised by the Department of Commerce. He also made a strong plea for support of the Federated American Engineering Societies and urged the Philadelphia Engineers' Club to become a member.

Advantage was taken of the occasion to present to Mr. Hoover an illuminated certificate of honorary membership, to which he was elected Nov. 11, 1919, in "fullest appreciation of the eminence attained by him in the field of engineering and of his great service to humanity." Guilliaem Aertsen, president of the Engineers' Club, presented the certificate.

John C. Trautwine, Jr., spoke on "The Engineers of Philadelphia," Dean Dexter S. Kimball of Cornell University, on the "Federated American Engineering Societies," and George Wharton Pepper, of the Philadelphia bar, on "Hoover as a Citizen." Joseph A. Steinmetz, past-president of the Engineers' Club, was toastmaster.

Mr. Hoover's address will be printed in next week's issue.

## Reppert Appointed City Engineer of Pittsburgh

Charles M. Reppert has been appointed chief engineer of the Bureau of Engineering of Pittsburgh, Pa., and will assume the duties at once. Mr. Reppert is a graduate of the College of Civil Engineering, Cornell University, class of 1904, and has been engaged practically all of his professional life in Pittsburgh. He was in the service of the city for a number of years, latterly in charge of sewers. At the outbreak of the war he became attached to the cantonment division of the army and was in charge of sewerage and water supply during the construction of Camp Meade, in Maryland. He then became assistant chief engineer of the housing division of the United States Emergency Fleet Corporation. Since the war he has been connected with Morris Knowles, Inc., of Pittsburgh.

## Highway Departments Queried as to Policy

**Committee Representing Automobile and Farm Interests Seeks Information About Federal-Aid Work**

State highway departments last week were asked to supply information involving present and future policies of federal-aid work and prospective measures for the construction and maintenance of a system of interstate highways. The request took the form of a questionnaire letter issued by a committee representing the National Grange, United States Chamber of Commerce, American Automobile Association, National Automobile Chamber of Commerce, and the Federal Highway Council, this committee having been formed in 1919 at the request of Senator Charles E. Townsend to collect information which might be useful in amending the present federal-aid road act. The letter, which is addressed to the heads of all state highway departments and signed by Thomas C. Atkeson, Washington representative of the National Grange, asks the following questions:

1. Are you confining the expenditure of federal-aid funds to a selected system of inter-county state roads? If so, what is the mileage of the state system and its percentage of the total road mileage in your state?

2. Do you consider it wise to expend federal-aid funds on the grading and drainage of roads over clay or alluvial soils in the humid sections of the United States without providing at the same time for an adequate hard surface of gravel or better, so that the roads will be suitable for travel at all seasons of the year?

3. Are the funds used in meeting federal aid in your state contributed by the state, or by the counties, or both; and is any money taken from the motor vehicle fees?

4. Are the roads on which federal funds are spent in your state maintained by the counties, or by the state, or by the counties under state supervision?

5. In case additional federal aid is granted by Congress: (a) Would your department favor confining the federal funds to a limited system of inter-county state roads, selected by state and federal authorities?

(b) Do you think that your state would be willing to provide the funds and to assume absolute responsibility and control over the maintenance of all federal-aid roads in your state without calling upon the counties for financial assistance?

(c) Do you believe that a percentage of the federal-aid allotment to each state should be set aside for the maintenance of previously constructed federal-aid projects in the various states, to be met with state funds in the same proportion as allotted for construction purposes?

(c) If not, how would you suggest

that money be provided for the adequate maintenance of federal-aid roads?

(d) Do you think that the legislature of your state would provide state funds to meet federal-aid without calling upon the counties for financial assistance in the construction of all federal-aid projects?

6. In the event that additional federal aid is granted for a limited period of years along the lines indicated by the above questions, do you think that the people of your state would favor a federal system of inter-state roads laid out by federal highway authority in co-operation with state highway departments as to location, construction, and maintenance, all expenses connected therewith to be borne by the federal government, the work to proceed in each state as nearly as possible at the same time?

## City Manager Plan Proposed for Cleveland

The committee of fifteen, at Cleveland, Ohio, created some three years ago to consider the city manager plan for that city, has approved an outline for charter amendments and proposes to carry on a city-manager plan campaign during the next two months. The outline provides for a city council of from 15 to 25 members, elected from several rather large districts, the councilman from each district to be nominated by petition and elected to give proportional representation. The council would be vested with all legislative and executive power, but would exercise the latter through a city manager appointed by it. The manager in turn would appoint all heads of departments, with the possible exception of the director of law and director of finance, who might be appointed by the city council.

## Colorado Revises Engineers' License Law

A revised license law for the practice of professional engineering and land surveying has been enacted by the Colorado legislature. It conforms closely with the uniform license law drafted by Engineering Council. The original Colorado law, which was one of the pioneers, lacked a reciprocity clause. A new feature is a clause empowering the board of examiners to use surplus funds to pay traveling expenses of a representative to the council of state boards of engineer examiners.

The clause relating to corporations engaging in the practice of engineering follows that of Engineering Council; it provides that persons in the corporation in charge of the designing or supervision which constitutes such practice be registered.

The Colorado Society of Engineers, which sponsored the first law took a leading part in the revision but the bill was recommended by the Colorado Engineering Council and its eight member organizations, which includes sections of the four founder societies, the engineering group of the Denver Civic and Commercial Association, Colorado Society of Engineers, Colorado Scientific Club and Teknik Club. The State Board of Examiners also endorsed the revised bill.

## Governor Appoints Members to New York Port Authority

Governor Miller of New York on April 16 named the three New York members of the Port of New York Authority and the nominations were immediately confirmed by the Senate; they are Eugenius H. Outerbridge, former member of the New York, New Jersey Port and Harbor Development Commission, ex-Governor Alfred E. Smith of New York State, and Lewis H. Pounds, ex-Borough President of Brooklyn, who is a real estate dealer.

Both New York and New Jersey had already adopted the bill authorizing the compact between the two states for the development of the Port of New York and the creation of the Port Authority. Previous to last week the second bill providing the means of appointment of members to the Port Authority had become law in New Jersey and had been passed by the Senate in New York. Last week it was passed by the Assembly and signed by the Governor.

The second bill itself, in New Jersey, named as the members of the Port Authority the three New Jersey members of the New York, New Jersey Port and Harbor Development Commission. They are Frank R. Ford, DeWitt van Buskirk, and J. Spencer Smith.

The government of the City of New York, at this writing, still has pending an application before the Supreme Court of the State of New York for an injunction to restrain the commissioners from signing the port compact with New Jersey. It is expected that an early decision on this application will be made.

## County in New Jersey to Have Own Road Material Plant

Plans and specifications for a complete road-materials storage plant, providing adequate storage facilities for bituminous materials used in road construction and for surface treating, for Bergen County, N. J., have been drawn by Dow & Smith, consulting engineers, New York City. The plans call for the erection of four 50,000-gal. storage tanks, two 4,000-gal. heating tanks and a concrete and hollow tile cement storage warehouse 25 ft. by 40 ft. The plant is to be located at Hackensack, N. J., and will be situated on the Erie R.R., county authorities having constructed a siding on the property.

The capacity of the new plant is based upon the demonstrated requirements of the county, the annual consumption of bituminous materials of all kinds alone in new construction and surface treatment being in the neighborhood of 1,500,000 gal.

## Further Study of Milwaukee Water Filtration Problem

Acting upon the report of a committee of the local section of the American Chemical Society to the effect that the construction of a water filtration plant for Milwaukee should be postponed until further experimental work is done upon problems of precipitation, filtration and chlorination, or even until the sewage-works now under construction is in operation and has shown its effect upon the water-supply, Mayor Hoan has appointed Harrison P. Eddy, of Metcalf & Eddy, consulting engineers, Boston, Mass., to report upon the whole situation. The report of the committee of chemists, as noted in our issue of April 7, p. 604, disagreed with the conclusion of J. W. Ellms, consulting engineer of Cleveland, Ohio, that the immediate construction of a filtration plant is advisable. Mr. Eddy has been consulting engineer for the Milwaukee Sewerage Commission.

## Garbage and Refuse Disposal Plant for Baltimore

Garbage disposal at a central reduction plant, with a maximum daily capacity of 300 tons and at an estimated cost of $1,000,000 for construction; rubbish disposal in four incinerators, each having two 15-ton units located at different parts of the city, at an estimated construction cost of $180,000; and disposal of ashes by filling are the chief recommendations of a report made to W. F. Broening, Mayor of Baltimore, by the Department of Public Improvement, H. G. Perring, chief engineer. The report, which is dated April 9, also recommends that until the garbage reduction plant can be built the garbage be buried on the city farm at Graveyard Point. Another recommendation is that the night soil of the city be disposed of by dumping at the Black River sewage-works. The report recommends very strongly that everything pertaining to the collection and disposal of garbage, rubbish, ashes, and other city wastes be done by the city. A careful investigation of the possible use of trucks and trailers in garbage and waste collection and a study of the whole collection system are advised in the report. It is proposed that after collection, the garbage be removed quickly to relay stations and thence to the proposed central reduction plant by truck and trailer, or by trolley, railroad, scow or other means.

## Ocean Beach Improvement Planned at San Francisco

Plans are being completed for the extension of the esplanade along the ocean beach near the Cliff House at San Francisco, the improvement of the bluffs of Sutro Heights and the paving of the upper end of the highway around the bluffs. The work is to cost $200,000 and is to be started soon, according to reports from the city engineer's office.

## U. S. Roads Bureau Discusses Arkansas Situation

### Federal-Aid Projects Free From Abuses, Says McDonald—Local Laws at Fault

Federal-aid road projects in Arkansas, according to a statement issued this week by Thomas H. McDonald, chief of the U. S. Bureau of Public Roads, after an investigation of the situation, are notably free from the serious conditions which are said to surround other highway construction work in the state. The conditions complained of (see *Engineering News-Record*, April 7, p. 611) are found to be mainly in the road districts created by special local laws which specialists of the Bureau of Public roads have unsuccessfully endeavored to have changed. The statement says, in part:

"The state law, known as the Alexander law, though not perfect, provides sufficient safeguard to protect the public interest and to prevent confiscatory taxation. It provides that assessments shall not exceed 30 per cent of the assessed valuation of the property. Of 96 projects which have advanced to the point where the Government is apprised of the details of the laws creating the districts in which they are located, 43 are in road districts created under the Alexander law, and 52 are in road districts created by special laws. One project, which has been completed, was initiated by a county and was not in a road district.

CREATION OF ROAD DISTRICTS

"Under the Alexander law, the right of appeal from the assessments levied is protected. To establish a district the county court must have a petition signed by a majority in land value, acreage, or number of land owners in the territory affected. The proposal must be advertised for 3 weeks, and any property owner has the right to protest at any time within 30 days. In certain special districts, on the contrary, it is alleged that the limit on assessments is raised to a practically confiscatory level, that unjust discriminations are made in the law and that, on account of special provisions, assessments are not always in proportion to benefits. The districts are created by acts of the legislature and not upon petition of the land owners, and opportunity for appeal is usually denied. The time allowed for appeal against the assessments is usually reduced to 2 or 3 weeks.

"Though a number of Federal-aid projects are in such districts, the Department of Agriculture has not been advised of any injustice in connection with federal-aid projects. In every case the legal procedure required has been followed to the letter.

"The principal difficulties which the Government has encountered in its work in Arkansas have arisen from causes altogether aside from the acts creating the districts. They are due mainly to the peculiar conception of the Federal-Aid Road Act held by officials of the state highway department, which has led them to act as though the only function of the Secretary of Agriculture was to approve any project which the state department might submit. It has been necessary on a number of occasions to deny the correctness of this interpretation.

"Further trouble has been caused by the ill-advised promises of federal assistance made by persons connected with or associated with the state department. These promises have been made without definite knowledge as to whether there would be money enough to fulfill them, or whether the details of the projects submitted would be satisfactory to the Federal Government.

"The Department of Agriculture, through its specialists in the Bureau of Public Roads, has made several efforts to assist the state in the correction of the laws and the conditions which are now complained of, but has met with no great success on account of local resistance. The only hope of improvement is in a realization of the seriousness of the situation by the people of the state."

## Resolution Offered for Federal-Aid Road Investigation

Senator William H. King, of Utah, on April 12, submitted to the Senate a resolution calling for the appointment of a special committee of the Senate to make an inquiry into the subject of federal-aid to the states in the construction of post roads, including the allotment and expenditure of appropriations under the Federal-Aid Act, methods and expenses of administration, supervision and overhead charges not actually expended in road construction, and work accomplished by such expenditures. The resolution also indicates that the inquiry, if made, will endeavor to determine whether or not wasteful and extravagant practices have been followed, and whether or not a propaganda has been carried on to induce larger and further appropriations by Congress.

The resolution also refers to charges of waste and extravagance in the expenditure of federal moneys on road work and to what is termed interference with the authority and powers of the officials of several states having charge of road construction.

## Competition for Sewerage Plan for Chauny, France

American sanitary engineers are invited by the American Committee, La Renaissance des Cites, with headquarters at 248 Boylston St., Boston, Mass., to enter "an inter-allied competition" for a sewerage plan for Chauny, France. It is hoped that the competition will "develop ideas which will be useful in many manufacturing towns of medium size" in France. There will be two prizes, one of 10,000 and one of 5,000 francs. Plans must be submitted by June 10, 1921. Sketches and other information needed by contestants may be obtained from the French headquarters of La Renaissance des Cites, 23 rue Louis-le-grand, Paris, France, for 65 francs ($4.55 at present exchange rates) of which 50 francs will be returned when the documents are sent back. Information may also be obtained from the American Committee, named above.

Among the engineers connected with the committee are Frederick H. Fay, Edwin Farnham Greene, Charles T. Main, and Edwin S. Webster, of Boston, Mass.; Profs. George F. Swain and George C. Whipple, of Harvard University, Cambridge, Mass.; George W. Fuller and E. F. Goodrich, of New York City; Harland Bartholomew, of St. Louis, Mo.; and Charles Saville, of Dallas, Tex.

# ENGINEERING SOCIETIES

## Calendar

### Annual Meetings

AMERICAN ASSOCIATION OF ENGINEERS, Chicago; Seventh Convention, Buffalo, N. Y., May 9, 10 and 11.

AMERICAN SOCIETY OF CIVIL ENGINEERS, New York; Annual Convention, Houston, Texas, April 27-30.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS, New York; Spring meeting, Chicago, May 23-26.

AMERICAN WATER WORKS ASSOCIATION, New York; Convention, Cleveland, June 6-10.

AMERICAN SOCIETY FOR TESTING MATERIALS, Philadelphia; Annual meeting, Asbury Park, N. J., June 20-24.

NATIONAL FIRE PROTECTION ASSOCIATION, 87 Milk St., Boston. Annual meeting, San Francisco, June 14-15-16.

**The Engineers Club of Indianapolis, Ind.,** is being addressed, at its regular weekly meeting April 27 by P. J. Walsh on "Modern Building Methods." Mr. Walsh is the Hoggson Brothers' superintendent in charge of construction on the new sixteen story bank-and-office building for the National City Bank of Indianapolis which has been designed and is being constructed by Hoggson Brothers, New York and Chicago bank building specialists.

**The Illinois Section, Am. Soc. C. E.,** April 12, was addressed by A. S. Baldwin on the proposed new constitution. Few dissenting arguments were advanced and unanimous approval was finally given with a recommendation that the Houston convention accept for transmittal to letter ballot without amendment. In answering a criticism similar to that made in *Engineering News-Record* of April 7, p. 579, to the effect that *nomination* ought to be made exclusively by the districts Mr. Baldwin stated that council had ad-

vised the committee that the whole election proceeding according to New York State constitution must be left open to all members. Mr. Baldwin expressed the feeling that the sections would function as primary caucuses in the selection of presidential nominees. Although it was the general opinion that this would nearly always throw the nominations to the large centers no one had a better method to offer. A startling statement was made to the effect that the secretary elected by the board could not legally be a member thereof. In consequence all actions in which he has cast a deciding vote could be upset.

## PERSONAL NOTES

R. E. CALDWELL, of Caldwell & Richards, civil engineers, Salt Lake City, Utah, has been appointed state engineer of Utah by Governor Charles R. Mabey.

PROF. IRA O. BAKER, acting head of the civil engineering department, University of Illinois, after 47 years' teaching service, will resign at the end of the school year.

BENJAMIN B. SHAPIRO, formerly chief engineer for Holabird & Roche, architects, has opened a consulting office for the practice of civil and structural engineering especially in relation to the design of modern steel and concrete construction. Previous to his 5½-year engagement with Holabird & Roche he was 3½ years with The Worden-Allen Co., steel fabricators, Milwaukee.

H. B. HOMMON of the U. S. Public Health Service, has recently been appointed to head the sanitation work in United States National Parks with headquarters at San Francisco where he is expected to arrive May 10.

CHARLES GILMAN HYDE, professor of sanitary engineering, University of California, has been named as consultant in connection with the sanitation work in United States National Parks, at the San Francisco headquarters.

J. E. WORLEY has been appointed chief engineer of the Kansas Public Utilities Commission with headquarters in Topeka, Kan. He has been employed by the New York Commission of freight supplies, the New York Public Service Commission, the U. S. Government in the construction of League Army and Navy Yard, the Valuation Department of the Central R.R. of New Jersey.

F. T. CROWE, reclamation engineer, who assisted in the construction of the Arrowrock dam in Idaho and built several dams on the Flathead project in Montana, has been selected to take charge of the Tieton dam, near Yakima, Wash.

WILLIAM C. PICKERSGILL, for nine years connected with the engineering staff on the design and construction of the Catskill aqueduct and for three years designing engineer for the City of Providence, R. I., Water Supply Board, has entered private engineering practice and is prepared to furnish reports and designs for water-works, sewerage systems, refuse disposal, ventilating system, industrial plant layouts, pier and waterfront work, steel frame and reinforced-concrete buildings.

A. J. RHODES has been appointed city engineer of Manhattan, Kan.

JOHN CHAMBERS, city engineer of Louisville, Ky., has been appointed chief engineer and superintendent of the Louisville Water Co.

F. R. HEWETT has resigned as county construction engineer of Adams County, Wash., to accept a position with the Washington State Highway Department.

G. C. STURMAN has been appointed county construction engineer, Adams County, Wash., to succeed F. R. Hewett, resigned.

JOHN H. BABBITT, formerly assistant on the engineering corps of the Akron division, Pennsylvania R.R., is now assistant engineer on the engineering corps of the New Castle division, Baltimore & Ohio R.R.

C. T. JACKSON has been appointed district engineer, southern district, Chicago, Milwaukee & St. Paul Ry., succeeding D. C. Fenstermaker who has been granted leave of absence.

H. J. SAMS, recently county engineer of Napa County, Cal., is now field engineer with the Portland Cement Association with headquarters at San Francisco, Cal.

CHARLES R. SELKIRK, formerly president of the Prospect Constructive Co., Philadelphia, Pa., contracting architects and engineers, has opened offices in Washington, D. C., to engage in the practice of engineering and architecture.

HERBERT L. SHERMAN, formerly president of the New England Bureau of Tests, and, during the World War, in charge of inspection for the Construction Division of the army, has associated with H. J. Skinner and Gustavus J. Esselen, Jr., under the firm name of Skinner, Sherman & Esselen, Inc., chemists and engineers, with offices in Boston, Mass. Mr. Sherman is an expert in cement and the testing of structural materials.

THURMAN W. DIX, since 1914 assistant professor of civil engineering at the University of Vermont and during that time, for three years, city engineer of Burlington and, for two years, testing engineer for the State of Vermont, has been appointed state highway commissioner of Vermont.

DR. SELSKAR M. GUNN, associate director of the International Health Board of the Rockefeller Foundation, and formerly secretary of the American Public Health Association, has been appointed by the government of Czecho-Slovakia as technical adviser to the ministry of public health and physical education.

G. H. CHALMERS of Sudbury, Ont., has been appointed resident engineer on the construction of extensions to the water-works system at St. Thomas, Ont.

EDWARD M. FULLER, civil and mining engineer, formerly superintendent of mines for the Mutual Coal Co., Rains, Utah, has entered private practice in general engineering in Price, Utah.

COL. JAY J. MORROW, Corps of Engineers, engineer commissioner of the District of Columbia during the administration of Presidents McKinley and Roosevelt, and chief engineer (with rank of brigadier-general) of the First Army, A. E. F., in France during the war, has been appointed governor of the Panama Canal Zone to fill the vacancy caused by the retirement of Brig.-Gen. Chester Harding.

WILLIAM C. TUTTLE has been appointed superintendent of highways and water-works of Attleboro, Mass.

## OBITUARY

THOMAS H. WALKER, chief inspector of the engineering department, Kansas City water-works department, died in Kansas City, March 20. He was born in Lockport, N. Y., in 1857. He was one of the oldest employees of the Kansas City water department and supervised the construction of many of the trunk and distributing water mains of the city.

WILLIAM G. WILKINS, consulting engineer and head of the firm of W. G. Wilkins Co., died April 12, in Northside, Pa. He was born in Pittsburgh, 1854, and was graduated from Renssalaer Polytechnic Institute in 1879. Soon after graduation he entered the employ of the Mississippi River Commission. From 1880 to 1887 he was assistant engineer of construction with the Pennsylvania R.R. In 1887 he opened an office in Pittsburgh as civil engineer and architect and in 1890 the firm of Wilkins & Davidson was organized. In 1900 the firm was dissolved and has since continued under the firm name of W. G. Wilkins Co. Mr. Wilkins has designed and built many industrial plants in Pennsylvania and adjoining states among which are the plants of the H. C. Frick Coke Co., the Cascade Coal & Coke Co., the Whipple Colliery Co., and the Chartiers Coal & Coke Co.

# Business Side of Construction

*Facts and Events that Affect Cost and Volume*

## To Resume Work on $2,500,000 Rimrock Dam

Work on the $2,500,000 Rimrock impounding dam near the head-waters of the Tieton River, has been resumed by the U. S. Reclamation Service, with headquarters in Yakima. The construction of the dam, intended to create a large storage basin for the irrigation of the Yakima Valley lands, was begun five years, but was interrupted in 1917, when the United States entered the war. More than $750,000 of the appropriation of $2,500 000 will be expended during the present year, and before the end of May 700 men will be employed on the work. F. T. Crowe, supervising engineer of the project, is located at Yakima.

The Rimrock dam will create a deep artificial lake 7 miles long and mile wide in certain stretches by flooding land adjacent to the river. The reservoir, intended for storage purposes, will impound 185,000 acre-ft. The dam will be of earth and rock fill type of construction, 900 ft. long and 200 ft. high, and will contain about 1,785,000 cu.yd. of material. The completion of the reservoir will permit of reclamation of about 75,000 acres of arid land in the Yakima Valley, where 360,000 acres have already been reclaimed. When war stopped the work, about $400,000 had been expended.

## Hetch Hetchy Tunnel Contract Is Relinquished

D. D. DeLucca, a subcontractor on the Hetch Hetchy tunnel which is being built for the City of San Francisco, has relinquished his contract and his part of the work is being carried on by the Construction Co. of North America, the main contractors on the 18 miles of tunnel now under way. DeLucca held the subcontract for the 9 miles of tunnel at the upper end. The 9 miles on the lower end is under subcontract to A. C. Dennis, who is making good progress and is reported to be doing the work considerably below the contract price.

## International Chamber to Hear Building Problem Discussed

The Associated General Contractors of America has appointed a general committee headed by N. S. Hoggson, New York City, to prepare a discussion of American building problems at the convention of the International Chamber of Commerce at London the latter part of June. The committee is composed of sixteen members of the A. G. C., and from among them will be chosen the representatives who will go to the London convention.

## Boston Chamber Report Assigns Causes to Building Inaction

The special committee of the Boston Chamber of Commerce, appointed Dec. 23, 1920, to investigate the building situation, has made its report. Causes for building inaction are ascribed chiefly to high cost of building materials, inefficiency of labor, and labor waste due to union working rules and conditions. In the public hearings which the committee held from Jan. 31 to Feb. 11 it examined many representatives of all elements in the building industry.

The committee found that present wage rates represent a percentage of increase over the wage rates prevailing in 1911 of from 66⅔ to 237 per cent, varying with the particular trade. The smallest percentage of increase was found in the mason and bricklaying trade, and the largest in common labor. The average hourly rate of wages in fifteen occupations of the building trade was found to be 96.8c. in 1920 as compared with 50c. in 1914, an increase of 93.2 per cent during the six-year period.

As to the inefficiency of labor, the committee reported it to be a more or less natural condition springing from circumstances existing during the war in which there was a sudden demand for all classes of labor in excess of the supply.

## Contracts for First Quarter of 1920 and 1921 Compared

### March 1921 Exceeds March 1920, Excluding Industrial Work—Street and Road Contracts High

An analysis of contracts let, as reported in *Engineering News-Record*, for the first quarter of 1920 and 1921, shows the following salient facts: (1) That the total value of all contracts let in 1921 is approximately 50 per cent of contracts let in 1920; (2) that, excluding contracts let in industrial work, 1921 values are 65 per cent of 1920 values; (3) that, during 1920, there was a general decline from the first of the year in the value of building done; (4) that there has been a remarkable increase in the value of contracts let in 1921; and (5) that, excluding industrial work, the total value of contracts let for March, 1921, exceed those let during March, 1920.

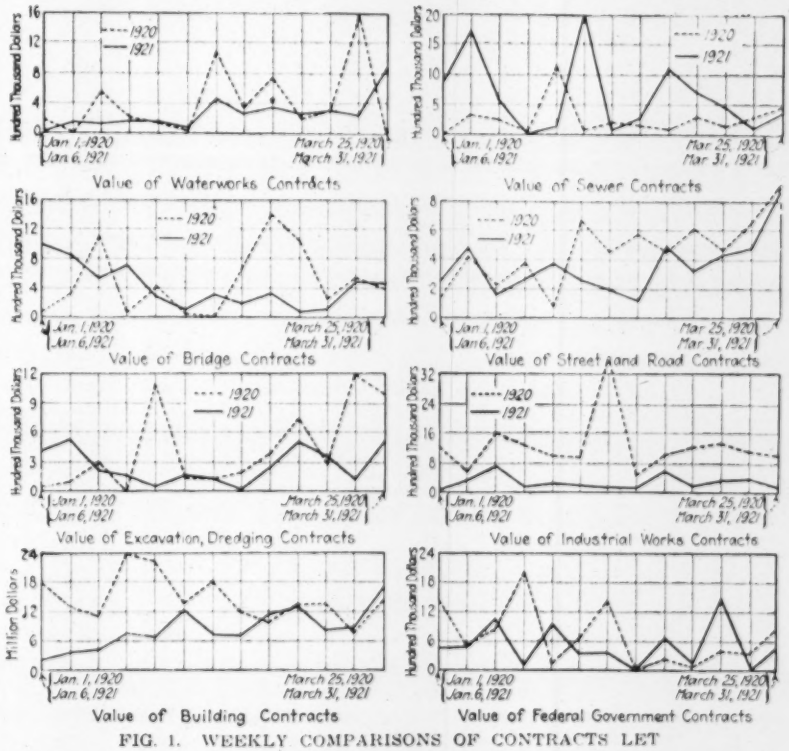



FIG. 1. WEEKLY COMPARISONS OF CONTRACTS LET

The total value of all contracts let for the first quarter of 1920 for all classes of building was $473,365,525 as compared with a total value of $229,599,769 for the first quarter of 1921. However, the greatest amount of the discrepancy between these two figures is attributable to the practical cessation of industrial building. The total value of those contracts alone were in excess of $168,000,000 during 1920, whereas in

1921 their total value is only about $36,000,000.

In all classes of construction the total value of contracts let in March 1921 are found to be 75 per cent of the value of contracts let in March, 1920. However, disregarding the value of industrial contracts, the comparative money value of all contracts for the two months are: 1920, $100,078,251; 1921, $97,252,481. This does not take into account the current cost of construction as compared with cost a year ago, a discrepancy which amounts to at least 10 per cent in favor of 1921. Assuming that building costs are 10 per cent lower now than a year ago, this increases the March, 1921, figure to approximately $107,000,000 — $7,000,000 more than March of last year. None of these figures take residential construction into account, as *Engineering News-Record* reports upon housing projects only in excess of $25,000.

The value of contracts let for the first three months of 1920 were: (1) January, $175,163,766; (2) February, $149,261,676; and (3) March, $148,940,083. For the first quarter of 1921, the figures are: (1) January, $54,408,367; February, $62,906,791; and March, $112,284,611. Thus it is seen there was a considerable decline in the value of contracts let in March, 1920, over those of January, 1920, whereas the March, 1921, contract value is a little more than 100 per cent in excess of the January, 1921, contract value. It is believed that the contracts let for the coming spring months will exceed those of March, 1921, inasmuch as a steady increase in the number of street and road and miscellaneous building projects put uner contract is noted. This belief is substantiated by the fact tnat for the first week of April the number of projects advertised was 22 per cent larger than the average for March of this year and the number of projects put under contract during the first week of April exceeded the March weekly average by 13 per cent.

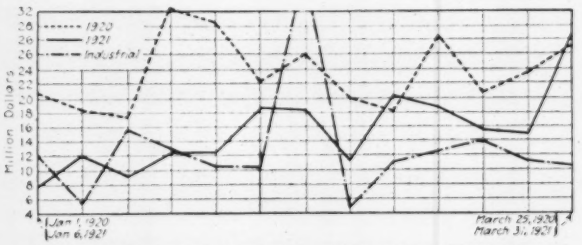



FIG. 2. COMPOSITE CURVES EXCLUDE INDUSTRIAL WORK—THIRD CURVE IS 1920 INDUSTRIAL WORK

In order to give a general idea of the trend in various classes of construction, comparing the first quarters of 1920 and 1921, the accompanying charts have been made, based upon contracts let as reported in the Construction News of *Engineering News-Record*.

Though the week-to-week reports make the curves appear erratic, a study will indicate that there is more steadiness in all classes of construction for the first quarter of 1921 than obtained for the corresponding period of last year. As the curves indicate, only in industrial work does the curve of 1920 keep continuously above that of 1921.

The composite curves in Fig. 2 are a comparison of all contracts let during 1920 and 1921, excluding industrial-building contracts. The curve for industrial building for 1920 is also included with the composite curves. It is generally accepted that at least immediate future building will concern itself primarily with needed construction. In view of that fact, the value of industrial contracts is omitted from the composite curves.

## Reject Bids for New York Barge Canal Equipment

All bids received by the War Department April 7, for New York State Barge Canal equipment, except that for one tugboat, were rejected by the chief of inland and coastwise waterways service. In accordance with the recent act of Congress directing the discontinuance of operation by the Government of the fleet of barges on the New York State Barge Canal, the War Department offered 75 per cent of the entire fleet for sale by sealed bid. Nine bids were received, but the only one accepted was that of the Niagara Ferry Co., Grand Island, N. Y., of $7,177 for the tug "Lenahan."

The equipment offered for sale is valued at $2,000,000, and consists of 15 self-propelled barges, 38 steel cargo barges, 16 concrete cargo barges, 3 wooden barges, 3 small tugs, and 10 wooden coal barges. With the exception of 3 wooden cargo barges and 3 small tugs, all of the equipment was constructed for the Government within the last few years and designed for the canal service.

## German Steel Trust Dead

(*Berlin Correspondence*)

The *Stahlwerksverband*, which is the official title of the German steel trust, has just delivered its report covering the time between July, 1919, and June, 1920, at which latter date the business activities of the corporation ceased. The beginning of the dissolution of the trust dates from the early stages of the war when it commenced to totter on account of the steadily growing tendency of its members to free themselves from all restrictions with regard to production and distribution. It is believed the trust would have fallen to pieces earlier but for the fact that during the war the government brought influence to bear upon the steel works for the sake of the continuation of the trust.

## The Situation as Regards Building Labor

Boston and Denver, two cities in which the dispute over building wages has been felt the keenest, have undertaken construction on an open shop basis during the last few days.

As a result of the failure of the arbitration plan offered as a means of settlement of the strike of the building trades in Boston, the announcement has been made by the building trades employees association, that work will be resumed on an open shop basis. After unsuccessful attempts had been made by the Boston Chamber of Commerce and other organizations and individuals to end the strike declared in January as a protest against wage reductions, the state board of conciliation and arbitration took the matter in hand. The united building trades council, acting as a body, agreed to conciliate as did the building trades employers association until it was known that not all of the unions affiliated with the central union favored conciliation. On that basis, the employers refused to conciliate. The several attempts that have so far been made by the state board of conciliation to harmonize the disputants have failed.

Five trade unions in Denver refused to accept the reduced wage scales recently authorized by the state industrial commission, and are no longer recognized by the master builders association of Denver.

The situation in Rochester, N. Y., is practically the same, the members of six building trades recently meeting the proposition of reduced wages with a flat refusal. Conferences are being continued in the hope that some amicable adjustment may be made before May 1. Bricklayers and stonemasons in Chicago have rejected a proposed 20 per cent wage cut. The unions of Davenport, Iowa, are looking to Chicago, awaiting the outcome of the referendum there before a decision is taken in the matter of the approximate 20 per cent decrease recommended by the state builders exchange.

## Pine Output 70 Per Cent Normal

For the week ended Friday, April 1, 1921, 134 mills reporting to the Southern Pine Association showed an aggregate production of 70 per cent of normal. For that same week, orders exceeded the production for the week by 8 per cent, shipments by 5.3 per cent. These figures indicate that shipments are now only 25.8 per cent, and orders 23.8 per cent, below normal production.

## The Dillingham Bill Reintroduced

Senator Dillingham, shortly after the extra session of Congress convened April 11, reintroduced his immigration bill that failed of passage at the last session. The bill proposes to restrict immigration to 3 per cent of any ethnic group now in the United States.

## Detroit Voters Authorize Municipal Cement and Brick Plants

A charter amendment providing for the acquisition of a municipal cement plant and municipal gravel pits urged by the commission of public works was approved by the voters of Detroit at the recent election. This step was urged in view of the extensive building program anticipated by the city and in order that construction materials might be obtained from independent sources in the event that inflated prices continued to prevail. The amendment also gives the commissioner the power, with the approval of the common council, to establish and operate plants for the manufacture of common brick, vitrified crocks and creosote blocks.

The commissioner has estimated that a city-owned cement plant and gravel pit would result in a saving of at least $500,000 in one year, in view of the large amount of municipal street railway, sewer and paving work to be done, added to the routine needs of the department. This estimate does not include what might be saved by supplying cement by the city to the Belle Isle Bridge and public buildings, contemplated and under way.

Bids have not yet been asked for the acquisition of a municipal cement plant. City officials are awaiting the outcome of the third advertisement for bids on cement, previous bids having been rejected as too high. Bids will again be opened for furnishing 175,000 bbl. of cement before further steps are taken to erect or otherwise acquire a municipal plant.

## Permanent New York Branch Construction Congress Formed

The New York Council of the National Congress of the Building and Construction Industry was recently formed by representatives of all elements in the building industry. A committee of 40 was appointed to take charge of the details of organization. A preliminary meeting, at which time plans were laid for the formation of the New York branch, was held late in January, as reported in *Engineering News-Record*, Feb. 3, p. 239.

## A. G. C. and Construction Industries Confer on Immigration

At a recent meeting in Washington, representatives of the Associated General Contractors of America, and the National Federation of Construction Industries decided to oppose restrictive immigration measures of an emergency nature and to support legislation of a permanent, constructive character. It is understood that Senator Sterling intends reintroducing his immigration bill, with revisions, and it is this measure which the immigration committees of the two bodies are studying particularly.

## Contractors Service to Be Supplied By Surety Company

In order to supply complete information to contractors for all New York State departments, the American Surety Co., New York City, has opened a state surety bond bureau at 148 State St., Albany. The bureau will furnish without cost to its clients accurate contract news from every department as soon as the information is made available to the public. The work will be comprehensive, covering not only construction work, but also supplies of every kind. Some of the services of the bureau will be: Publication of daily bulletins containing notices of all state calls for bids on purchases, sales and construction work; the furnishing of bidding blanks and specifications to all contractors interested; telegraphic notice of bid openings and awards; filing of bid papers; reporting of bid openings, with prices.

## Westinghouse Plans to Build California Plant

As a result of a visit to the Pacific Coast during the latter part of 1920 of two of the officials of the Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa., a 12-acre tract of ground has been purchased at Emeryville, Cal., by the company upon which it plans to erect buildings that will give increased advantage and space to the San Francisco service shop and warehouse. This building will be followed by the erection of additional buildings to provide facilities for assembling electrical machinery for use on the Pacific Coast. The plant will probably be used ultimately for building and testing electrical machinery and will prevent delays in shipment and in many ways contribute to better service for Pacific Coast cities. Plans for the first group of buildings comprising an approximate floor space of 120,000 sq.ft. are now being prepared by the company's architect at East Pittsburgh.

## Guy Breaks, Derrick Falls, Killing Workman and Wrecking Steel

When a guy rope that anchored the dead-man of a 7-ton steel derrick used in erecting the steel trusses for a theater in Irvington, New Jersey, parted April 13, the derrick fell, killing one workman, injuring three others and wrecking the steel. The derrick was being taken down, the six 86-ft. roof trusses having just been set in place. It was in the approximate center of the building and fell to the rear, the end of the dead-man cutting a hole in the masonry wall and the steel boom striking the top of the wall bending over it. The guy that broke was said to be a new one. Some of the steel members can be salvaged. Aside from slight damage done by the boom and dead-man the masonry wall was not injured.

## Past Week Is Record for Year in Value of Contracts Let

The value of contracts let, as reported in *Engineering News-Record* during the past week total $30,874,237, the highest weekly figure of the year. The record is attributable to the large number of street-and-road contracts let and to the steady increase in miscellaneous building. Pennsylvania let highway contracts aggregating in excess of $3,000,000, and Ohio, contracts valued at $847,496. Most of the other street-and-road contracts are small, as is indicated by the fact that 142 projects total in value $13,807,195. Miscellaneous building contracts represent an aggregate value of $13,441,493, the largest projects being two $2,500,000 hotels, one in Windsor, Ont., and the other in Cleveland.

## Atlas Co. Issues Statement on Cement Prices

According to a statement recently issued by the Atlas Portland Cement Co., New York City, its cost of manufacturing cement was 30 cents a barrel higher for 1920 than on Sept. 1, 1918, the date on which the government fixed the price of cement at $1.75 per barrel. The recent report made by the United States Geological Survey showed that the average selling price of the Lehigh Valley district for the year 1920 was $1.91 per barrel. The statement of the Atlas Co. is that its average was below this figure. The Atlas Co. therefore points to the fact that though the difference in the cost of manufacture was 30 cents a barrel the increase in the price fixed by the government was only 16 cents per barrel.

The increased cost of manufacture of 30 cents per barrel for 1920 over the four-month period ending with Jan. 1, 1919, the Atlas Co. finds accountable to a 46 per cent increase in labor cost, 20 per cent increase in coal and 23 per cent increase in materials and supplies.

Though these figures indicate a greater increase in mill cost than in selling price, the increased output during 1920 more than offset the differences reflected in the yearly income, continues the Atlas statement. The Lehigh Valley district is used in the comparison because of the much larger output of the Atlas Co. in that district. The Atlas statement gives a figure substantially under 10 per cent as its income for all plants in 1920 on its capital investment.

## Record Number Freight Cars Idle

Previous records for the number of surplus or idle freight cars on the railroads of the United States were broken during the week ended April 8, according to reports just compiled by the car service division of the American Railway Association. The number of cars for which there was no freight averaged 507,427, or approximately 21 per cent of the total freight cars owned by the railroads of the United States.

This is an increase of over 11,000 cars as compared with the previous week, and an increase of 210,000 cars since the first of the year. Of the total number of idle cars 261,294 were coal cars, an increase of about 6,000 cars in a week, while there were 176,916 surplus box cars, an increase in a week of 5,000. At the time of the business depression in 1919, following the armistice, the number of surplus freight cars reached 451,739 for one week of March.

## Building in New York Cities

According to the labor market bulletin issued by the bureau of statistics and information of the New York State Industrial Commission, building permits issued in the first- and second-class cities of the state took a sudden upward turn in February, the estimated value of authorized building work for that month being $24,817,935. This is an increase 3 per cent over the February, 1920, total.

## Slight Decrease in Wholesale Prices Noted in March

According to a bulletin recently issued by the U. S. Bureau of Labor Statistics the weighted index number of wholesale prices compiled by the bureau stood at 162 for March, as compared with 167 for February and 177 for January. Full information on specific commodities is contained in Bulletin 1079, Department of Labor.

# Weekly Construction Market

THIS limited price list is published weekly for the purpose of giving current prices on the principal construction materials, and of noting important price changes on the less important materials. Moreover, only the chief cities are quoted.
The first issue of each month carries complete quotations for all construction materials and for the important cities. The last complete list will be found in the issue of April 7, the next, on May 5.

| Steel Products: | New York | Atlanta | Dallas | Chicago | Minneapolis | Denver | San Francisco | Seattle | Montreal |
|---|---|---|---|---|---|---|---|---|---|
| Structural shapes, 100 lb. | $3.33 | $4.25 | $3.75 | $3.23 | $3.51 | $4.65 | $4.45 | $5.00 | $5.00 |
| Structural rivets, 100 lb. | 4.85 | ..... | 7.05 | 4.88 | 5.30 | 6.90 | 7.05 | 6.25 | 8.50 |
| Reinforcing bars, ¾ in. and larger, 100 lb. | 3.23 | 3.75 | 3.85 | 3.13 | 3.53½ | 4.22½ | 2.35 | 4.50 | 4.25 |
| Steel pipe, black, 2½ to 6 in. lap, discount | 49% | 50.60–5% | 40@45% | 58½% | 51.9–5% | 38@40% | 44@47 | 40% | 5% |
| Cast iron pipe, 6 in. and over, 100 ton | 63.30 | 59.22 | 66.20 | 64.10 | 67.80 | 70.00 | 87.65 | 73.00 | 80.00 |
| **Concreting Material:** | | | | | | | | | |
| Cement without bags, bbl. | 3.10 (del.) | 3.00 | 2.85 | 2.17 | 2.41 | 3.10 | 3.09 | 3.10 | 3.44 |
| Gravel, ¾ in., cu.yd. | 2.50 | 2.80 | 1.75 | 2.75 | 2.00 | 2.50 | 2.50 | 1.50 | 1.50 |
| Sand, cu.yd. | 1.25 | 1.50 | 1.75 | 2.75 | 1.00 | 1.10 | 1.65 | 1.50 | 1.50 |
| Crushed stone, ¾ in., cu.yd. | 2.15 | 2.50 | 3.20 | 2.75 | 2.25 | 3.50 | 2.50 | 3.50 | 2.10 |
| **Miscellaneous:** | | | | | | | | | |
| Pine, 3x12 to 12x12, 20 ft. and under, M.ft. | 48.00 | 38.00 | 45.00 | 55.00 | 38.00 | 47.00 | 27.00 | 28@30 | 120.00 |
| Lime, finished, hydrated, ton | 21.00 | 18.00 | 25.00 | 20.00 | 29.00 | 32.00 | 25.40 | 24.00 | 30.00 |
| Lime common, lump, 200 lb. bbl. | 3.30 | 1.60 | 2.50 | 1.65 | 2.00 | 3.20 | 2.25 | 2.75 | 15.00 |
| Common brick, delivered, 1,000 | 18.40 | 12.00 | 25.00 | 12.00 | 18.00 | 14.00 | 18.00 | 19.00 | 18.00 |
| Hollow building tile, 4x12x12, block | Not used | 0.14 | 0.21 | .12 | .06 | .10 | .12½ | .13 | .19 |
| Hollow partition tile 4x12x12, block | .... | .15 | .19½ | .096 | .104 | .10 | .14½ | .11 | ..... |
| Linseed oil, raw, 5 bbl. lots, gal. | .65 | .68 | .88 | .71 | .75 | .93 | .88 | .79 | .95 |
| Common labor, union, hour | .75@.80 | .35 | .60@1.00 | 1.00 | .50 | .50@.63½ | .81½ | .75 | ..... |
| Common labor, non union, hour | ..... | .25 | .40@.60 | .50 | .50 | .37½@.50 | .50@.55 | .50 | .30@.40 |

**Explanation of Prices**—Prices are to contractors in carload lots unless other quantities are specified. For steel pipe, the prevailing discount from list price is given: 45-5% means a discount of 45 and 5 per cent, 45@50 means a range of 45 to 50 per cent. **New York** quotations are delivered except tiles, which are "on trucks." Sand, gravel and crushed stone are quoted alongside dock. **Chicago** quotes hydrated lime in 50-lb. paper bags. **Minneapolis** quotes on fir instead of pine. Brick is $18 delivered, 16 on cars. Gravel, sand and crushed stone quoted at pit. Common labor not organized. **Denver** quotes cement "on tracks"; gravel and sand at pit, stone on cars, lime, brick and lumber on job. Tile price is at warehouse. Linseed oil, delivered. **Atlanta** quotes sand, stone and gravel per ton instead of per cu. yd. **Dallas** quotes lime by the 180-lb. bbl. **San Francisco** quotes on Heath tile, 5½ x 8 x 11½. Prices are all f.o.b. warehouses except C. I. pipe, which is mill price plus freight to railway depot at any terminal. Lumber prices are delivered "at ship tackle in San Francisco ex mill." **Seattle** quotes on Douglas fir, instead of pine; and on lime in paper bags. **Montreal** quotes sand, stone and gravel per ton, and lump lime by the ton. No organized common labor in Montreal.

## Changes Since Last Week

The decrease in U. S. Steel Corporation mill prices, noted on p. 660 of the Apr. 14 issue of *Engineering News-Record*, has had little effect on warehouse prices owing to the fact that the warehouses had already reduced prices to agree with a $2 base at Pittsburgh. It is still possible to buy certain products under the Steel Corporation prices. For example, plain reinforcing steel can be bought for $3.23 delivered in New York, as against the Corporation price of $3.38. The extra for twisted reinforcing steel is 12½c. per 100 lb. Present prices of light rails per 100 lb., delivered in New York are: 8-lb., $3.59; 12-lb., $3.54½; 16@20-lb., $3.50; 25@45-lb., $3.45½. Following is a comparison of the new mill prices with prices delivered in New York:

| | Mill Pittsburgh | Delivered New York |
|---|---|---|
| Bars | $2.10 | $3.23 |
| Plates | 2.20 | 3.33 |
| Structural shapes | 2.20 | 3.33 |
| Wire nails | 3.25 | 4.00 |
| Tin plates | 6.25 | 7.50 |

The only change in the New York market is a further decrease in the price of linseed oil. The oil dropped also in Atlanta, Chicago and Denver. While brick quotations in New York are practically the same as last week, being $15 as against last week's $15 to $16 at wholesale, the market is "softer." Common brick dropped $2 in Denver. Tile is down 1c. per block in Denver; and can now be bought in Montreal for 19c. per block, as against a former price of 28c. Hard wall plaster is $21.75 per ton in Montreal, an advance of 75c. Montreal reports that few price reductions are expected and that labor is plentiful.

Atlanta announces reductions on steel and cast-iron pipe as the result of a manufacturers' decrease. Lower prices on shapes, rivets and reinforcing bars are expected by May 1.

As regards the Chicago wage dispute, on Apr. 16 70 per cent of the unions had refused to accept the proposed cut from $1.25 to $1 per hour on skilled labor, and from $1 to 75c. on common. The Employing Contractors' Association delivered an ultimatum to the effect that $1 will be the maximum wage after May 1. Serious resistance by labor is not anticipated.

Minneapolis reports that the unions will decide by May 1 whether to accept or reject the reduced scales. A number of the St. Paul unions have rejected proposed cuts, and have taken steps to enter the construction field, by farming out their own building organizations.